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The names of the research and experiment stations at which the experiments summarised in the *Journal* have been conducted are indicated in italics, thus :—(*Rothamsted*). In the case of experiments conducted abroad, the name of the country is given.

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THE FRENCH AGRICULTURAL LABOUR PROBLEM.

The Work of the French Peasant Women.—When the history of French achievement in the present war comes to be written, a brilliant chapter will be that devoted to the work accomplished by the French peasant women.

The situation on the French farms after mobilisation must have been sufficiently unnerving. Apart from the women, in very many cases none but children and old men were left. Great demands were made by the military authorities on French farm horses, and the autumn manuring could only be carried out with great difficulty, as part of the artificial manures had been requisitioned for the manufacture of explosives, while the rest remained at the railway stations for lack of transport facilities.

The peasant women, however, did not lose courage, and it is due to them that the agricultural life of France was not almost totally suspended. Making great efforts, they bravely took the place of the men. M. Méline, just prior to becoming Minister of Agriculture under the Briand Government, relates as a typical example how he had "surprised an old woman of 65, fork in hand, gaily doing the work of a mobilised nephew." They sowed, cultivated and harvested; they led the horses and attended the cattle; they faced the roughest work; and they spent the evenings in making up accounts after the hardest work in the field in the daytime. They carried on the farm-work even in the "Army Zone" behind the trenches, and many of them have not hesitated to cultivate their farms under fire.

After the first shock of war the task confronting the women did not get easier; one by one further classes of men were called up,* and the story of the French agricultural labour

* By May, 1915, all available men of 18–48 years were under arms.

problem is to a large extent that of the way in which these women have been able to draw on various resources which the country has attempted to place at their disposal. It is a great tribute to these admirable women that many of them have tolerated the presence of German prisoners even while mourning the death of a husband or brother.

It is recognised in France that the strain of 18 months work under such conditions cannot have been without effect, and there is no doubt that in some cases women have given up and left the land*; but the conviction is expressed that the others will long find the strength to continue the fight.

In a circular issued at the beginning of November, 1915, the French prefects were instructed especially to give their attention to holdings deprived by mobilisation of their men managers. "Local authorities must furnish them not only with material aid (see later), but must also seek to bring them moral comfort. Such support is all the more necessary because, by reason of the call of the men to the Colours, the care of organising and directing the execution of agricultural work falls at present on the women. This task, which they have courageously assumed since the beginning of the war, becomes from day to day more difficult, and may often appear above their strength. It is necessary to give them determination to endure to the end."

The Director of the Central Syndicate of French Agriculturists has recently suggested that the directors of agricultural syndicates should be given leave from military service to devote themselves to the task of combating discouragement among French peasant women.

The Work of Prisoners of War.—The employment of prisoners of war in France is regulated by a decree which lays down the conditions that the work must have no connection with the operations of war, and must not be excessive; officers may not be employed.

Prisoners' labour was made use of from the first by the Ministry of Agriculture for works of general or collective necessity in agriculture, such as agricultural improvements, land reclamation, drainage, roads, plantations, etc In this way thousands of prisoners of war have been employed on agricultural work.

Apart from State employment, the Ministry of War was at first very loath to allow prisoners to aid in agricultural work; it probably feared the escape of the prisoners or the

* The preamble to a Bill of February, 1916, appears to indicate that these were principally metayers wives. These were attracted by the high prices to be realised by selling their live stock.

hostility of the populace. Lapse of time, however, calmed popular feeling somewhat, and the necessity of supplementing other measures in aid of the supply of agricultural labour became urgent. The majority of the prisoners apparently ask for nothing better than a renewal of active life.

From January, 1915, onwards, in the department of Côtes du Nord the general commanding appealed to foresters to employ prisoners.

At the beginning of February, 1915, a contract was made between the general commanding the 15th district and the Co-operative Association of Agricultural Syndicates of the department of Gard, of which the following were the chief conditions:—

(1) Only groups of at least 25 men were to be engaged and were to be employed in collective work by members of the Association. The prisoners were preferably to be chosen from among those occupied in agricultural work in the country of origin.

(2) The military authority had under its charge the surveillance of prisoners, their feeding and clothing, payment to them of pocket-money, their transport, and liability for accidents.

(3) The Association engaged to lodge the prisoners and their guard, to allow 5½ lb. of long straw per man (guard and prisoners) per fortnight, to provide all materials necessary for work, to pay to the military authorities per man per hour of work 0 fr. 20 c., the "day" of employment to be 9 hours in February and 10 hours in March, and the work to be carried out under masters appointed by the Association.

(4) The accounts were to be settled every fortnight.

(5) The transport of prisoners was only to take place after authorisation by the military authorities.

(6) The Association was to give 10 days' notice of the fact that the prisoners were no longer required.

In this way one of the members of the Association obtained on the spot 45 prisoners under 12 territorial guards, the number being increased in May to 60. The results, reported on 1st May, on the work done, were so satisfactory and the prisoners were so quiet and submissive that other members of the Association were encouraged to employ prisoners.

It was apparently a circular of the Ministry of War of 6th May, 1915, that finally standardised the procedure for obtaining the services of prisoners of war.

The Ministry of War will only put prisoners at the disposal of communes, syndicates or other associations in certain districts (*i.e.*, excluding frontier districts). They must be employed in groups of at least 20; they can move from village to village in case of successional work. When food and lodging are supplied by the cultivator the latter must pay 0 fr. 40 c. per man per day (20 c. for dress and 20 c. for pocket-money);

if lodging is provided, but not food, the employer must pay in addition 1 fr. 03 c., or, where nothing is found, an additional 1 fr. 17 c. per day. The commandant of the squad can, if the work is admittedly badly done, stop the 20 c. pocket money, but the allowance may be increased to 40 c. if the work is well done (or extra food may be given).

These groups of prisoners seem generally to have given complete satisfaction. By 22nd May they had been employed in sowing large areas which would otherwise have remained uncultivated. Their work is much sought after, especially in districts where the larger holdings are numerous. Among the prisoners suited for agricultural work very few have been unoccupied.

Application to the military authorities is made through the mayor of the commune, and transmitted by the latter to the prefect of the department. The general in command of a district allocates the labour of prisoners among the various departments comprised in the district after consultation with the prefects of the departments. The mayors and presidents of agricultural syndicates have then to distribute the prisoners as best they can. Owing to the demands for prisoners' labour it has been found prudent to make application far in advance, and even then application may not be successful.

The prisoners must work in the fields only (not in the village) and to facilitate surveillance they must be grouped as much as possible, so that in a district where the holdings are small it is necessary to prepare a plan of work in advance. The minimum group of 20 prisoners must be employed for at least a week.

In general the *commune* has to get ready the prisoners' quarters, which must afford easy surveillance. The prisoners must be bedded on straw mattresses, with 5 kilos (11 lb.) of straw renewed every fortnight: further quarters must be prepared for the guard. The food is generally furnished by the *employer* and is supposed to be equal to that of the French soldiers in peace time; the food of the guard has generally also to be provided, although quarters, pay and clothing are at the charge of the State. It is found in the employer's interest to have the cooking done by village women, so that all the prisoners can work in the fields. The clothing is provided by the military authorities, with the exception of work overalls which the employer furnishes.

The employer is supposed to engage a doctor for a weekly visit. The sick are looked after at the cantonment, and are not

paid. Those who fall ill or are the victims of accidents are taken to the nearest military hospital and cared for at the State's expense. The employer in general incurs no liability for accidents, but he is forbidden to give the prisoners dangerous work.

It has been found necessary to have a guard permanently, and of at least two men at a time, besides which certain administrative duties are involved (care as to correspondence, etc.). The guard is thus supposed to consist of a corporal, a sub-officer and an interpreter-secretary, together with 9 men, or, in all, 12 " unproductive " men, but this number will be the same for a gang of 40 prisoners as for one of 20.

The employer furnishes the tools, and directs and surveys the labour, but he must not employ other labourers than the prisoners on the particular piece of work.

The prisoners' correspondence has to pass through the district war prisoners' depot.

The military authorities can recall all suspected prisoners, even though they may be good workmen. In the case of bad workmen, pocket-money is first stopped, followed, if desirable, by recall to the depot. A complete gang of prisoners can be withdrawn by the military authority if the employer does not fulfil his obligations.

The number of hours of effective work is 10 per day, *i.e.*, 11 hours in the fields, reckoning an hour for meals; but it has been found a good plan to give the prisoners a quarter-hour's rest in each half-day. No Sunday work may be done except by express permission of the military authority, and this is only given in cases of particular urgency.

The employer has to make up his accounts relating to prisoners' labour each evening, transmitting them to the prisoners' depot each fortnight, the depot undertaking the distribution of pay to the prisoners.

The necessity of paying prisoners seems to have caused disappointment in some quarters in France, as it was erroneously supposed that prisoners' labour would be gratuitous.

It is now (March, 1916) the intention to organise the prisoners (preferably agriculturists) into large companies on a methodical plan (*e.g.*, specialists in one kind of work in the same gang) so that they traverse the different districts of the country, arriving at each at the time when its agricultural work is most urgent.

Miscellaneous Sources of Labour: The Work of the Agricultural Labour Office.—Immediately after the outbreak of war applications from industrial workmen, thrown out of employment,

were received at the Ministry of Agriculture; of over 3,000 who thus offered themselves after the beginning of hostilities, 2,600 sought work as reapers. More than 12,000 applications for employment from syndicates, agricultural societies and private companies came from Alsace-Lorraine, Italy and Spain, through the Belgian and Rumanian legations, and these were replied to by an agricultural labour service organised at the Ministry of Agriculture.

On 6th August, 1914, a committee under the Minister of the Interior was formed to study, *inter alia*, the measures to be taken to remedy unemployment and the supply of agricultural labour; and on the 7th August a committee was instituted under the Minister for Agriculture to study questions relative to the maintenance of the agricultural activity of the country.

Through the efforts of the large agricultural societies and other bodies a considerable number of the applicants for agricultural labour were soon employed. In the departments of Seine-et-Oise and Loir-et-Cher more than 700 Belgians were provided with work. In other districts men from the adjoining countries were employed; thus several hundreds of labourers of French origin who had settled near Geneva were employed in 35 communes of Haute Savoie.

At the time the Government was transferred to Bordeaux the official attempt to solve the agricultural labour problem seems to have been abandoned for a time, though several large private organisations did good work.

By January, 1915, the train service had resumed something like normal conditions, and a better distribution of men was possible; communes, associations, rural industrial concerns and individual farmers were invited to address their requirements for labour to the Ministry of Agriculture. It was stated that labourers would, as far as possible, be grouped into gangs placed at the disposal of municipalities who would distribute them with special regard to farms depleted of labour by mobilisation.

On 20th March, 1915, the Minister for Agriculture appointed a commission on agricultural labour, consisting of nine administrative representatives and 13 representatives of agricultural societies. At a sitting on 22nd April the organisation of an Agricultural Labour Office which had been set up on 15th March to secure a better co-ordination of supply and demand was settled.

The Office commenced work with information acquired by the National Society for the Protection of Agricultural Labourers and the Committee of Agricultural Refugee Labour,

two bodies which had been doing useful work. The bulk of the expenses of the Office was met by subventions from the Ministry of Agriculture, but the leading agricultural societies also contributed. The aims and methods of the Office were made widely known by press notices and posters.

Lists of French and Belgian refugees were transmitted to the Office, which addressed individual propositions as to employment to them; efforts were also made to recruit foreign and African labour. The Report of the Office for 15th August, 1915,* shows that between 15th March and 31st July, the Office received 12,488 offers of employment; 9,125 demands for employment; and "placed" 6,018 refugees and unemployed, 14,820 men, 1,081 women and 1,074 children foreigners (mostly Spanish) and 821 Kabyles (Algerians). The Office is still (March, 1916) doing good work, and is at present occupied in recruiting civilian labour (unemployed, refugees and cripples) for the spring agricultural work.

It may be of interest to give further particulars as to these various kinds of labour:—

French and Belgian Refugees.—The great difficulty at first with regard to the employment of refugees and some classes of unemployed in agriculture was the fact that the Government had made an allowance to them of 1 fr. 25 c. per head per day, in the case of adults, and ½ fr. in the case of children, or had otherwise given help. There is no doubt that some refugees tried to live on this help without doing any work; further, those who accepted or were willing to accept work were apprehensive lest the grant should be stopped if they showed that they could support themselves. Lastly, employers in some cases took advantage of the grant and tried to get refugees to work for them at very low wages. After a period of conflict between the Ministry of Agriculture and the Ministry of the Interior the matter was settled by a circular of 6th May, 1915, addressed by the Minister for Agriculture to prefects instructing them that on no account was the grant to be withdrawn from families supplementing their resources by agricultural work; interested persons were also advised of the fact by Press communiqués. The number of refugees and unemployed offering themselves thereafter sensibly increased.

This decision necessarily had as its counterpart the possible withdrawal of the grant from persons refusing work under suitable conditions as to remuneration. Although it was made known through the Press that the Minister for Agriculture

* The last seen.

had power to act in this way. no such action seems ever to have been taken.

Further difficulties in the way of employing refugees were that owing to fear of espionage it was impossible to employ them near the armies; some refugees amused themselves by travelling over the country at the State's expense under the pretext of finding more remunerative work; while others refused work on arrival, thus embarrassing their would-be employers.

With regard to transport of refugees and unemployed who are found agricultural work by the Office, these were, on requisition being addressed to the railway companies, carried free to the locality of the employers, the latter having to pay to the State, at the cessation of hostilities, one-fourth of the cost of the journey. The requisition was granted by the Agricultural Labour Office direct to the employee when informed of the conclusion of the arrangement between employer and employee.

The Office was bound not to intervene in the discussion between employer and employee, a fact which some employers do not seem to have understood, asking the Office for a report on the aptitude, morality and temperance of the employee.

Foreign Labour.—Foreign labour was practically confined to Spanish labour; Italy, even before her entry into the war, prohibited workers being recruited for a belligerent country, while obligation to military service hindered Swiss agricultural labourers from emigrating.

Immigration of Spanish agricultural labour into the south of France has been considerable in recent years. The Office set itself the task of organising the introduction of this labour. The difficulties arising out of the French "state of siege" were first surmounted, then permission was obtained from the Ministry of the Interior to suppress the passport on account of its expense and replace it by a residential permit (*carte de séjour*) granted at certain frontier points, provided the particulars of identification were satisfactory.

French recruiters have been much hampered in Spain by certain parties, and the Spanish Government itself has not been very favourable to the plan; it requires the production of individual contracts of employment carrying a guarantee to return the labourer free to the frontier on the expiry of the work.

The procedure in obtaining Spanish agricultural labourers is as follows:—A committee must be set up in each department to centralise the demands of agriculturists and engage to take a certain number of labourers; when these labourers have been

collected in Spain they journey to France in a body. On arrival at the frontier each labourer must possess a ticket supplied by the French Agricultural Labour Office (presumably the *carte de séjour*) and a certificate of hire legalised by the mayor.

The Office has obtained from the railway companies the right for these labourers to journey at half rates; the Compagnie des C. de F. du Midi grants a 75 per cent. reduction per trainload of labourers.

At a meeting of the French Academy of Agriculture in November, 1915, it was stated that, between March, 1915, and that date, 30,000 Spaniards had been brought to France.

Algerian Labour.—The 821 Kabyles mentioned on p. 7 were sent in July, 1915, and were placed in the department of Eure-et-Loir, the prefect distributing them between the different holdings. These succeeded so well that some time after a further 215 were sent to the Department of Loiret. They were transported free and were paid at the rate of 5 fr. per day (3 fr. 50 c. if food found).

The Work of Soldiers.—As time went on it became increasingly evident that the use of soldiers' labour on the land offered the one really effective means of combating the scarcity of agricultural labour. It was likely at the outset that there would be difference of opinion between the military and agricultural authorities,* and, even when arrangements were entered into between the different ministries, friction seems to have arisen between local army officers and agriculturists. The history of this side of the agricultural labour problem is that of the gradual granting of concessions to the agricultural interest. The hands of the latter were strengthened by the growing conviction of the likelihood of a war of endurance, and the consequent necessity of keeping up the food supplies of the country and limiting indebtedness for imports.

From an official report it appears that, early in the war, 20,000 *navy* conscripts were lent to the Ministry of Agriculture to be divided among the departments where the need of agricultural labour was greatest.

The Agricultural Permissions.—With a view to getting the autumn sowings done in 1914, leave of absence was obtained for territorials, who were sent home for 15 days for the purpose. The instructions of the Ministry of War were that they should exert their whole energies to preparing and sowing the ground; those who had so little land of their own, that their work could

* The commandeering of agricultural labourers for work on the entrenched camp of Paris, and the maintenance of soldiers in idleness in the depots, seem to have been especially bitterly received by the agricultural population.

be finished in a few days, were to employ the rest of their leave in assisting other cultivators, more especially working on the land of those who were mobilised and unable to obtain leave of absence. The mayors were requested to assist in the proper organisation of the work, and, whenever possible, to arrange collective labour. The mayors were responsible for the certificate in support of the cultivator's request for leave of absence, and were also charged with the duty of seeing that the man returned to his post after leave of absence.

The next "permissions" were those accorded in the spring of 1915 to territorials in certain depots for spring sowing, vine pruning and spring work generally. The period was again a maximum of a fortnight, and the permission was accorded to owners, tenant farmers, metayers, agricultural labourers and farm-servants; they could work either at their own homes or for others so long as they did not enter certain prohibited districts. Mayors were again made responsible for the supervision of this labour. The concession was extended also to guards of the means of communication. These permissions lasted from 5th February to 5th April, 1915. Special provisions were made for spring work in the army zone by territorials in the depots.

The hay harvest claimed attention in the next place. "Permissions" of a fortnight, between 15th May and 1st August, 1915, were accorded to territorials and territorial reservists in the interior zone, and to guards of the means of communication in the interior zone. The permissions related solely to agriculturists, and did not apply to work in certain districts. Territorials native to these latter districts could obtain permits provided they did not return home and allowed themselves to be hired in a district to which access was authorised. The soldiers had to rejoin immediately they were required. Requests for permissions had to be addressed by the soldiers to their military superiors.

At the beginning of June, 1915, the agricultural permissions were extended to farriers and repairers of agricultural machinery. The following circular addressed at this date by M. Millerand (Minister for War) to the generals commanding the different districts is interesting: "I take this opportunity of calling your attention to the necessity of giving the widest interpretation to my circular of 3rd May [as to hay harvest permissions]. Hay harvest is one of the most delicate of agricultural operations on account of the celerity required for its success, and of the large losses which may result from a lack of labour at the critical moment. In particular it has

been notified to me that certain territorials have been refused permission because they were only lately incorporated or because they were in a camp of instruction detached from the central depot. Such action is entirely contrary to my views: the agricultural permission must not be considered as an exceptional favour granted by way of reward, but as a normal method of putting indispensable labour at the disposal of the communes for urgent and incontestably important work. My wish is to bring the sincerest, widest and most efficacious aid to agriculture compatible with military necessities. I beg you to impress these ideas on your subordinates also."

A circular of the Minister for War, dated 5th June, 1915, authorised permissions to be granted to auxiliary service men, wounded or other men not mobilised on account of health, and formations in the interior zone other than the guards of means of communication.

Permissions to Non-Agriculturists (Gangs).—A valuable concession was made by the Minister for War in the middle of June, 1915: this was the granting of permissions to those non-agriculturists who, having been accustomed to manual labour, could help farmers. Such men, however, were to be (1) organised in gangs (*équipes*) and put at the disposal of the communes for hay harvest for a minimum of a fortnight, and (2) chosen only from territorials, territorial reservists and auxiliaries not mobilisable before one month. These gangs were transported, fed, lodged and paid by the employer. Their number and composition, and the communes in which they could be employed, were regulated by agreement between the prefects and the generals commanding districts. At first the operations of these gangs were restricted to the districts closed to the "permissionaires," but later on this restriction was cancelled.

Towards the end of June, farmers were given power to demand the aid of soldiers of whatever class, outside the hours of military service and particularly on Sundays; such soldiers could bring small groups of non-agriculturists with them. Further, farmers were empowered to demand from the military authorities such animals as were not in use by the latter. These provisions applied to all work and not merely hay harvest.

In July the "gangs" were allowed to be used for threshing work; and permissions were granted to owners and mechanics of threshing machines.

There followed at about the end of July the extension of permissions from hay harvest to corn harvest; a man

who had obtained a permission for hay harvest could get a second permission of a fortnight's maximum for corn harvest up to 15th September, 1915; these privileges were also extended to the gangs of workers.

By this time further relief had been granted by extending the zone in which territorial and other "permissionaires" were allowed to go to their own homes to work, and in which they could be hired.

Next, in order to assure the wine harvest, the Ministers for Agriculture and War decided that permissions of a fortnight (independently of other permissions) could be granted between 5th September and 15th October, 1915, to viticulturists mobilised in the interior zone or in certain depots in the army zone; further, in departments where the wine harvest is particularly important, gangs of soldiers were to be placed at the disposal of the communes between those dates.

To provide for autumn work and sowing in 1915 it was decided that *two* permissions of a fortnight could be granted between 1st September and 15th December to various classes of soldiers who were agriculturists, and also to "gangs"; the permissions had to be *visé* by the mayor of the commune, whose duty it was to organise collective work. Animals were to be lent to agriculturists between 1st September and 1st November as in the case of hay and corn harvest. The generals commanding districts were invited to aid agriculturists to the greatest possible extent by multiplying the permissions and lending out all available animals.

By a circular of 25th October, 1915, the fortnight's permission could be extended in urgent cases, notably in bad weather; it was provided that the gangs *must* be furnished very largely *wherever they are asked for*, particularly for beet lifting. The mayors were instructed to transmit an account of the needs of their communes for labour and animals to the prefects, and the particulars so collected would serve as a basis for the demands addressed to the military authority and to the distribution of the supplies received.

On the same date a decree of the Minister for War was issued instituting in each army corps district in the interior zone a consultative committee for economic action with the duty of seeking measures to maintain and develop the agriculture and the agricultural industries of the district, notably by the rational employment of military and civil labour. The district committees were to be composed of a certain number of administrative officials, together with

two representatives from industry, commerce and agriculture from each department comprised in the district. Departmental sub-committees were eventually to be created.

Plans of the New French Ministry.—On the formation of the Briand Government it was apparently one of the first cares of M. Méline to suppress the resistance to the regular execution of the arrangements described above.* According to an agreement with General Gallieni all soldier agriculturists were given in principle the right to obtain two separate permissions. The organisation and distribution of the "gangs" were to be improved. Sub-divisional commanders were, after receiving the prefects' demands, to visit personally all formations and fix the contingents to be furnished by each. The happiest results were expected from the substitution of the *right* of mobilised agriculturists to enjoy permissions at opportune moments in place of the formalities previously surrounding permissions, and also from the fact that the constitution of gangs was no longer to be left to the whim of depot commanders.

The following declaration was made by General Gallieni in the Chamber on 30th November, 1915. He had agreed with the Minister of Agriculture on assuming office that agricultural labour was a highly important item in the national defence; district commanders, sub-divisional commanders and depot commanders had received formal instructions to keep constantly in touch with prefects, mayors, and local authorities so as to meet all demands as far as possible. With M. Méline he was preparing a veritable agricultural mobilisation for the spring of 1916.

M. Méline's plan was apparently to replace the intermittent small gangs by large ones (of say 1,000 men each) so that the work of a district could be completed in a short space of time. M. Méline at first held out no hope of soldiers ever being employed other than for a very limited period, as agriculture was not definitely a war industry. Compulsion was foreshadowed for the recipients of grants.

General Gallieni followed up his declaration by the issue on 22nd December, 1915, of a most important circular, in

* A preamble to a Bill of M. Méline's, some four month later, even, stated that it was indispensable to imbue the army officers, of whatever rank, with the idea that the soldier-agriculturists asking to work on the land were not "shirkers" (*embusqués*), but, on the contrary, Frenchmen who understand how doubly to fulfil their patriotic duty, by shedding their blood for the defence of the fatherland and by keeping their own fighters alive.

A further great cause of complaint was that even the best circulars of the Ministry for War were rendered inoperative by administrative formalities, labour, where granted, in many cases arriving too late.

which it was pointed out that, as agricultural work lasts over the whole year, it was impossible to continue the plan attempted in 1915 of regulating minutely the help to be given by the army to agriculturists in the case of each separate agricultural operation; and that the solution of the problem was to be found in a large decentralisation, so that help may be given in each case quickly and efficaciously, "the interests of the country being defended with good sense and not combated by regulations." General Gallieni consequently decided permanently to delegate to generals commanding districts his powers in this direction, under the control of general inspectors, with the object of lending the maximum amount of labour to agriculture compatible with the state of war.

In the instructions to these generals it is emphasised that "the regular, prompt, and (as far as possible) complete execution of agricultural work constitutes one of the essential elements of national resistance and consequently one of the principal factors of success. The full use of the soil must be obtained at all costs, equally with the supply of men and material to the army, or the supply of labour to factories engaged in national defence."

The generals are instructed to make use, in each department comprised in the district, of a consultative and executive commission composed of the prefect or his delegate, a general officer or his delegate, and the director of agricultural services of the department.*

In a circular addressed to prefects on 8th January, 1916, the Minister for Agriculture, in calling their attention to the above circular, impresses on them the necessity of preparing a plan for the mobilisation of agricultural labour for each type of agriculture in their departments; he instructs the departmental commissions that, in addition to advising the generals and carrying out the organisation of agricultural labour, they should keep in close touch with the departmental economic

* It may be of interest to indicate the type of instructions given by General Gallieni to generals commanding districts. The following is a circular issued by him on 28th December, 1915.

"The principal agricultural operations which it is necessary should be carried out at present are:—

(1) *Vine Pruning.*—This work requires, in the main, professional labourers. The best way of ensuring it, therefore, appears to be to grant permissions to mobilised vine-growers; to this could usefully be added the formation of gangs of labourers in the vine-growing departments.

(2) *The Preparation and Storage of the Tobacco Crop.*—This demands workers small in number but exclusively composed of specialists. It will be best carried out, therefore, by granting permissions to duly qualified tobacco planters.

I ask you to take all useful measures in the spirit of my circular of 22nd December, 1915, so that these two kinds of work may be regularly carried out."

committees created by the decree of 25th October, 1915 (see above). The generals commanding districts are to delegate their authority to the departmental commissions as far as possible, and the latter will, therefore, have the right to use all the machinery at present in existence to satisfy agricultural needs (individual permissions, gangs, prisoners of war, loans of horses, flying gangs) as well as to institute new arrangements. Only important litigious questions are to be referred to the general inspectors mentioned in the War Minister's last circular. The Minister for Agriculture states, in conclusion, that the great advantage of this rapid procedure is that it will put an end to the deplorable delays which have often deprived agriculturists of the benefits of the military concessions.

The present procedure, therefore, is that the commune ascertains the labour needed, communicates with the prefect, who in turn submits it to the commission of three members (of whom he is one). The general commanding must find this labour from among the soldiers who are agriculturists. The latter can themselves ask for permissions, and the military authority has to forward them to the localities where they will be most useful, either in gangs or individually, and they must preferably be sent to their own farms or neighbourhoods as often as possible. The commission has to inform the general commanding when the soldiers in the department are insufficient in number to supply the agricultural needs of the department, and the general has to ask the commissions of departments in which there is a surplus to come to the aid of the first commission. The generals commanding must make use of all sources of labour at their disposal (even the unfit and convalescent). Whole and half holidays are to be granted to soldiers so that they can help in the farm work of the neighbourhood.

Committees of Agricultural Action.—On 2nd February, 1916, M. Méline issued a decree providing for the formation in each commune of a Committee of Agricultural Action with the primary duty of cultivating abandoned farms, but since the labour question is the crux of the problem a good deal of their action is in regard to this point.

These committees are part of M. Méline's agricultural mobilisation plan. An appeal is made to the patriotism of the aged agriculturists of each commune. The mayor has to call all the farmers of the commune together and get them to elect the committee from among their number, the mayor being president of the committee. A survey must be made of the farms which have fallen out of cultivation and each member

of the committee must administer one or more of these,* and see also that help is given on farms where the men have been taken for the army. They have to police the unemployed and refugees, undertake the surveillance of permissionaires, and organise the communal "gangs." They collect the demands of the commune for soldiers' labour and forward them through the prefect to the commission of the department.

Their other duties relate to purchase of seeds, manures and machinery, and the provision of draught animals and agricultural credit, while they have also to forward complaints as to military requisitions and the prices paid by the military authorities.

* A Bill at present before the French Chamber (No. 1783, Chamber of Deputies, 1916) provides that the mayor of each commune, assisted by two municipal councillors, shall invite the owner, or customary occupier, of uncultivated lands to cultivate them if possible.

If within a fortnight the owner or occupier cannot show that the abandonment of the lands has been justified by reasons other than his own unwillingness, the mayor will have the right to requisition the lands and can hand them over, to be cultivated, to the "Communal Committee of Agricultural Action."

The mayor will further have the right, in order to carry out the cultivation, to requisition all agricultural implements, buildings and draught animals which are available in the commune.

The expenses and advances necessary are to be assured by the commune. Special advances are to be put at the disposal of the district credit banks to be lent by them in case of need to the communes demanding financial help from the Ministry of Agriculture.

The communal committee (or in default the municipality) is to supervise the work on these lands until the end of harvest and sell the produce (alternatively it can lease out the lands till harvest). After deducting any taxes, sums advanced, and interest, the rest will be handed over to the owners or occupiers if these had not been able to cultivate the land from some cause due to the war and independent of their own wishes, or, if this cannot be shown, one-third will further be deducted by way of fine and paid into municipal funds.

The principal points made in the preamble are as follows :—

(1) The agricultural problem, which was of secondary importance at the outbreak of war, on account of the self-sufficiency of France, has now become more acute owing to the difficulties of the agricultural campaign, and the situation may well become serious if steps are not taken to assure the feeding of the army and the civil population.

(2) The area of autumn-sown cereals was, in 1915, 739,000 hectares below that of 1914.

(3) A dearth of food is to be apprehended at the cessation of the war as a result of competition between various countries to replenish their depleted stocks from the existing supplies.

(4) The agricultural wealth of the country is the foundation on which other wealth is built, and with proper measures the breach in French fortunes can soon be repaired.

(5) Agriculturists must be helped with their heavy burdens ; the want of labour is the most grave cause of uneasiness, but further, machines are few and costly and the attendants and repairers are too often in the army, while manures are getting dearer and scarcer.

(6) Migration from the country has begun, and, although not yet very grave, must be dealt with. It has been most notable in metayage districts, the metayer or his wife being attracted by the profits to be realised on the sale of live stock. A certain number of women farmers have also given up their farms, and the unfortunate owners, often mobilised, or ignorant of farming, seek tenants in vain, most of these having been mobilised.

(7) If this situation is prolonged, without some attempt being made to remedy it, it is to be feared that the next harvest will be short and hundreds of millions of francs will go abroad

ECONOMY IN FOOD.

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MOST farmers have come to recognise that the diet of their stock must fulfil two purposes. It must supply sufficient proteins—also called albuminoids or "flesh-formers"—to replace the wear and tear of the working parts of the body, and, in the case of young animals, to provide for growth. It must also supply a sufficient amount of combustible materials, such as fats, oils, sugars, and starches, to provide the energy necessary for carrying on the functions of life.

If the diet supplies more food than is required for these two purposes the surplus is used by the animal for the production of growth, meat, milk, or work. It is generally recognised that the amount of growth, meat, milk, or work produced by an animal is limited by the extent of the diet. For instance, somewhere about a stone of hay per day will maintain an animal weighing about 9 cwt., so that its weight remains constant, but if the animal is required to grow in size, to get fat, to produce milk, or to do work, the diet must be increased, and the increase should take the form of some kind of concentrated digestible food which will not lose a large proportion of its energy in the process of digestion.

Whilst these general principles have received common acceptance in their application to the feeding of stock, few people realise that they apply with equal force to the nutrition of human beings. In these days of dear food, when economy is forced upon everyone for financial reasons, both personal and national, no excuse is necessary for the following remarks, which are intended to point out how the simple principles enunciated above may enable the housekeeper to effect considerable economies in catering for her household, and, at the same time, to avoid all risk of danger to health.

Just as is the case with animals, the diet of a human being must supply two things, protein for growth and repair, and combustible materials to provide energy. The amount of protein necessary for an average man weighing about 11 stone is 4 oz. per day. An average woman of 9 stone requires only about 3¼ oz., the amount required being roughly proportional to the body-weight. Children, however, require more protein in proportion to their weight than do adults, for in their case protein is required for growth as well as for repair.

Many people imagine, if indeed they allow their imagination to wander beyond the confines of their own personal preference,

that animal food is the only source of protein worth serious consideration. This idea is quite erroneous. As a matter of fact a pound of oatmeal contains as much protein as, and a pound of beans, peas, or lentils more protein than, a pound of the best sirloin of beef. Moreover, these vegetable foods contain over half their weight of starch, which in beef is replaced by water.

Cheese is the only common food of animal origin which contains as much protein, weight for weight, as beans and peas. It must not be forgotten that several foods of animal origin contain practically no protein at all. Among these may be mentioned butter, lard, margarine, suet, dripping, and cream.

Bread contains quite a considerable proportion of protein; indeed, more than half the protein in the diet of the wage-earning classes is taken in the form of bread. Obviously it is by no means necessary to eat enough animal food to supply all the protein required by the body.

Animal food, however, is more appetising for the majority of people, possesses a stimulating effect, and produces a feeling of vigour which cannot be imitated by any diet consisting of vegetable foods only. For this reason animal food is especially valuable for men (or women) engaged in strenuous work or exposed to physical hardships such as cold or wet. For those who lead a sedentary life, and even for those whose occupation does not entail considerable muscular effort, the amount of animal food in the diet may safely be reduced to very small proportions without risk of injury to health. In some cases, indeed, a decrease in the proportion of animal food in the diet would be beneficial.

The diet, however, must supply energy as well as protein. In the case of foods used for stock the energy value is commonly stated in terms of oil and carbohydrates (sugars and starches), or "heat formers," as they are sometimes called. In the case of foods for human consumption another practice is followed. Their energy value is usually stated in terms of heat units or calories, the calorie being the amount of heat required to warm 1 kilogramme (1¾ pints) of water through 1° Centigrade.

This is a very convenient way of stating the food requirements of the body, for it reduces all the constituents of the diet to one common denominator, their fuel value. Instead of having to state the amounts of the several constituents—proteins, fats, and carbohydrates—it is only necessary to give one figure, the fuel value in calories. The number of calories required per head per day will, of course, vary with

the amount of muscular work to be done, just as the amount of coal required by a steam engine depends on the amount of work it performs. The number of calories required by people engaged in various occupations has been determined many times with consistent results, as follows :—

	Number of Calories required per head per day.
Sedentary occupations	2,500
Clerks, tailors, shopmen, professional men ..	3,000
Mechanics, porters, carpenters, ordinary labourers.	3,500
Blacksmiths, dock labourers, soldiers in the field..	4,000 or more.

For all practical purposes it is sufficient to regulate the diet according to the number of calories required, since the composition of the usual articles of food is such that any mixed diet which supplies the requisite number of calories is certain to contain enough protein. It is, however, desirable that the diet should contain a fair proportion of fresh animal or vegetable materials which have undergone as little preparation as possible. Such fresh materials contain certain unknown constituents which are important to health and are liable to be destroyed or impaired by prolonged preparation of any kind, whether in the course of manufacture or cooking. For this reason fresh fruit, salads, and similar articles form a valuable addition to a diet, although they are of little importance as sources of protein or energy.

The cost of protein and of calories or heat units is strikingly different in different kinds of foods. In order to make full use of the information given above it is necessary to know the price at which protein and calories can be bought in the various foods on the market. This can be calculated quite readily from the known composition of the foods. An example will show the method. At the present time the cheaper cuts of beef cost 10*d.* per lb. They contain on the average 15 per cent. of waste and 50 per cent. of water, to neither of which constituents can any definite value be assigned, though a careful housekeeper will probably be able to use the waste for making soup or gravy. The valuable constituents are 15 per cent. of protein and 14 per cent. of fat. From the price of suet, lard, and margarine, which contain no constituent of value except fat, it appears that fat can be bought at the rate of one-tenth of a penny per one-hundredth of a pound. The 14 per cent. of fat in the beef is worth, therefore, fourteen-tenths of a penny, or almost exactly 1½*d.* Subtracting this from the total cost, 10*d.* per lb., the cost of the 15 per cent. of protein is 8½*d.* The cost of 1 lb. of pure beef protein in the cheaper cuts is, therefore, 4*s.* 9*d.*

Similar methods have been employed to calculate the cost of protein and of calories in all the common foods. The whole list cannot be included here*, but certain foods have been selected—those for the production of which the farmer is responsible. In the following table the first column gives the price per lb. of the food. These prices represent the prices at the present time. Any variation from time to time or from place to place can readily be corrected by making proportionate alterations in the other columns. The second column gives the number of oz. of protein in 1 lb. of the food. The cost of protein per lb. is given in the third column. The fourth column gives the number of calories which 1 lb. of the food is capable of producing. This number is found by burning a known weight of the food under conditions which enable the experimenter to measure the number of degrees of temperature through which the heat it gives out is able to warm a known weight of water. Finally, column five gives the cost of the food per 1,000 calories :—

NAME OF FOOD.	PRICE PER LB. 1	PROTEIN IN 1 LB.	COST OF PROTEIN PER LB. 3	NO. OF CALORIES PER LB. 4	COST PER 1,000 CALORIES. 5
	s. d.	*oz.*	*s. d.*	*Calories.*	*s. d.*
Meat—					
Beef, cheaper cuts	0 10	2½	4 9	1,006	0 10
,, sirloin	1 2	2½	6 5	1,108	1 0¾
,, rump steak	1 6	3¼	6 7	1,110	1 4¼
Mutton, scrag end of neck	0 10	2	5 7	1,055	0 9½
,, leg	1 2	2½	7 0	900	1 3½
Pork, leg	1 0	2¼	5 8	1,345	0 9
,, loin	1 2	2	7 4	1,340	0 10½
Bacon	1 6	1½	10 0	2,685	0 6¾
Dairy Produce and Eggs—					
New milk (per pint)	0 2	¾	3 7	406	0 5
Separated milk (per pint)	0 0½	¾	0 7	212	0 2¼
Cheese, Cheddar	1 0	4¾	2 6	2,055	0 5¾
Fresh eggs, each 1½*d.* (8 eggs weigh 1 lb.)	1 0	2	7 0	635	1 7
Vegetable Foods—					
Bread	0 2	1½	0 5½	1,225	0 1⅝
Oatmeal	0 3	2½	0 3	1,840	0 1⅝
Dried peas	0 3	4½	0 6	1,655	0 1¾
Dried beans	0 4	3¾	0 9	1,605	0 2½
Flour	0 2½	1¾	0 4½	1,650	0 1½
Potatoes	0 0½	¼	0 7¼	310	0 1⅝
Green peas	0 5	1	5 1	465	0 10¾
Carrots	0 0¾	⅐	5 1	160	0 4¾
Cabbage	0 1¼	¼	6 8	125	0 10
Onions	0 1	¼	4 6	205	0 5

* See, however, *Food Economy in War Time*, T. B. Wood and F. G. Hopkins (Camb. Univ. Press, price 6*d.*).

Foods containing practically no Protein.

	Price per lb.	Calories per lb.	Cost per 1,000 Calories.
	s. d.	*Calories.*	*s. d.*
Butter	1 6	3,605	0 5
Lard	0 10	4,010	0 2½
Margarine	0 6	3,525	0 1¾
Dripping	0 6	4,000	0 1½
Cream	1 2	910	1 3½
Jam	0 5	1,400	0 3½

The most striking point brought out by the tables is the comparative costliness of the protein and calories in animal foods. Protein in meat costs about as many shillings per lb. as the protein of the cereals costs pence. Calories in meat cost, on the average, about 1*s.* per thousand, whilst in cereals they can be bought at about one-sixth to one-eighth of that price. It has been shown above that, except in the case of people who are called upon to do very strenuous work, or to stand exposure to great physical hardships, the amount of animal food can safely be reduced to a small proportion of the usual allowance. The tables make it clear that by following such a course the housekeeper can effect very considerable economy.

Amongst foods of animal origin, dairy products such as milk, both new and separated, and cheese stand out as remarkable in their comparative cheapness. Separated milk is especially cheap as a source of both protein and energy; indeed, it is almost on a level with the cereals in that respect. No doubt the reason why it is so little used for human food is to be found in the high cost of transport of so comparatively bulky a material, but this reason does not apply in the country. Producers of separated milk should certainly make more use than they do of so cheap a source of animal protein, and would be doing a national service by encouraging their neighbours, especially their poorer neighbours, to do likewise.

Perhaps the best way of making the cheap animal protein of milk available for the general public would be to replace butter-making by cheese-making. Butter contains all the fat of the milk, and can be efficiently replaced by margarine. Cheese contains both the fat and the protein, and is consequently a more valuable food than butter. Moreover, the amount of milk which yields 1 lb. of butter, worth about 1*s.* 7*d.*, will yield more than 2 lb. of cheese—worth more than 2*s.*

THE WASHING OUT OF NITRATE FROM ARABLE SOIL DURING THE PAST WINTER.

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THE past winter has been much wetter than usual, and during the whole period, October–February, there was a considerable amount of rain-water percolating through the soil. The quantities are always fairly high, but they were exceptionally high in December and February. This is shown by the following figures obtained at Rothamsted :—

	Rainfall in inches. 1915–16.	*Average for 62 years,* 1853–1914.	*Percolation in inches.** 1915–16.	*Average for 35 years.*
September	2·49	2·34	0·83	0·86
October	2·60	3·17	1·45	1·83
November	2·38	2·60	1·93	2·10
December	5·56	2·53	5·32	2·02
January	2·24	2·33	1·83	1·79
February	3·97	1·82	3·39	1·39
Total for 6 months	19·24	14·79	14·76	9·97
Excess over average	4·45		4·79	

* Through 20-in. gauge.

It is well known that, in washing through the soil, water carries with it a considerable amount of soluble material. Two important effects are produced :—

(1) Some of the clay, the finest material in the soil, changes from the desirable crumbly state into an undesirable sticky condition, or, in the language of the chemist, it becomes deflocculated.

(2) Some of the nitrate, the extremely valuable plant nutrient, is washed out and lost from the land.

The change in the state of the clay is obvious to anyone walking over heavy land at the present time ; the surface has a glazed look, and the soil is very stodgy when picked up with a stick. Here the great value of chalking or liming is seen : chalked or well-limed land has a much better surface ; instead of being glazed it is pitted with numerous small holes, allowing of freer drainage and aeration ; it picks up better, and the melting snow gets away more easily than on land that has had no lime or chalk. Indeed, on the Rothamsted fields it is now possible to pick out the chalked plots simply by the feel of them as one walks over the land ; the distinction is perfectly sharp. Later on, however, it becomes less marked.

The loss of nitrate is not so obvious, but it is more serious to the farmer. It is least on heavy land, and greatest on good

land and on light land, as is shown in Fig. 1, but it mounts highest on land that was well done last year and either fallowed or bastard fallowed, these being the conditions under which the maximum amount of nitrate production goes on in the soil. Fig. 2 shows the changes in amount of nitrate that occurred last year on the Broadbalk dunged plots, one of which was fallowed and the other cropped. The amounts of percolation,

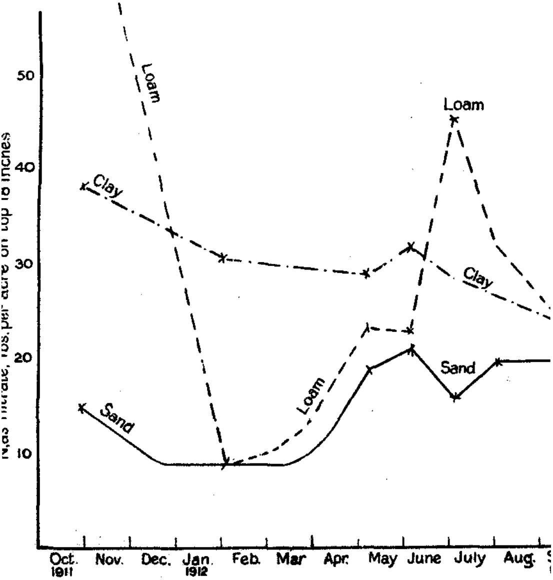

FIG 1.—Showing the Amounts of Nitrogen as Nitratein Various Soils at diffe Seasons of the Year. None of these Soils was highly manured.

as measured by the 20-in. gauge, are shown by columns, each representing the total percolation since the date of the one before it. Beginning with the fallow plot, it may be observed that from April to September nitrate was steadily accumulating in the top 18 in., excepting only in early May and early August, when percolation was high. By the middle of September the top 18 in. of soil contained 170 lb.

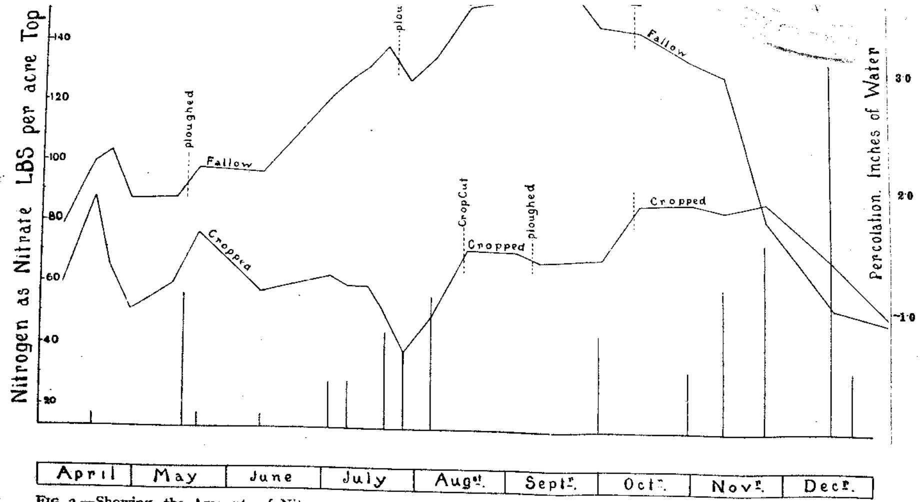

FIG. 2.—Showing the Amounts of Nitrogen as Nitrate in Cropped and Fallow Land, respectively, during 1915. The land is in good condition, receiving annual dressings of farmyard manure. The vertical lines represent the amounts of water percolating through the soil; where these run high, as in November and December, the nitrate falls very much in amount.

of nitrogen per acre in the form of nitrate, this being equivalent to no less than 1,100 lb., or nearly 10 cwt., of nitrate of soda. The accumulation then ceased and the losses began: throughout September and October the losses were not especially bad, but in November and December they were disastrous, so that when February arrived the magnificent September stock had been reduced to 50 lb. of nitrogen, equivalent only to 320 lb. of nitrate of soda.

The result of the winter rainfall, therefore, is that this plot, which had been well done and fallowed last year, and brought into high condition, has suffered a loss of 120 lb. of nitrogen, equal to 7 cwt. of nitrate of soda per acre, which at present prices is worth a good deal.

Fortunately all the ground has not lost so heavily. The cropped plot was never able to accumulate nitrate to anything like the extent of the fallow plot, partly because the organisms made less, and partly because the crop took up much of what was there. No more than 90 lb. per acre is ever shown in the analysis, but the fact that this amount was maintained in spite of the October and November percolation indicates that more had been produced but was washed away. Even as it is, a loss of 40 lb. of nitrogen is recorded, equivalent to more than 250 lb. of nitrate of soda, and as much as is contained in 24 bush. of wheat and the corresponding amount of straw. In the end, however, the soil begins the new season just as well provided with nitrate as the last year's fallow.

The losses from various plots were:—

	Nitrogen as nitrate: lb. per acre, top 18 in.		
	Autumn, 1915.	*February,* 1916.	*Loss.*
Broadbalk, dunged, fallow	175	50	125
,, ,, cropped (wheat)..	90	47	43
Great Harpenden Field, cropped (wheat)	70	40	30
Broadbalk, unmanured, fallow ..	68	40	28
,, ,, cropped (wheat)	51	46	5
Hoos, unmanured, fallow	34	9	25
,, ,, cropped (wheat) ..	32	12	20

Harpenden field represents fairly closely the ordinary case of land which is fairly but not unusually well done. It is not one of the experimental fields. It grew potatoes in 1914, when it had 12 loads of dung with artificials; then followed wheat without manure. This did not exhaust the stock of quickly-available nitrogen, for there was still 70 lb. per acre in the autumn of 1915 which might have gone a long way towards satisfying the needs of a second corn crop. During the winter, however, 30 lb. per acre was lost.

The Hoos field wheat plots are in lower condition than would be usual even on a poor farm: they have had no manure for over 50 years. The crop is always low, averaging only 16 bush.: there is no nitrogen to spare, yet even its small stock—which would have sufficed for 22 bush. next season—has been largely dissipated by the winter rain.

Taking the results as a whole, they show that the fields which had not been unusually well done lost some 30 lb. of nitrogen per acre, equivalent to 190 lb. of nitrate of soda, as a result of the winter rainfall, while the plots that had been well done lost considerably more.

The object of the experiment was to find out how much nitrogen had been lost. The question naturally arises, however, could the loss of nitrate have been avoided? Other experiments show that some of it could, especially the very heavy loss on the fallow plot. Had mustard or some quick-growing crop been sown in September when the soil was, so to speak, at the top of its form, the nitrate would have been taken up by the plant and held safe against washing by the rain. Then, if the mustard had been ploughed in or fed to sheep on the land, the nitrogen would have been returned to the soil, not, indeed, in so available a form as nitrate, but still in a form that would easily change to nitrate in spring and would in the meantime be safe from loss.

The obvious lesson is that land which has been got into a good state in autumn should at once be sown with either the crop it is intended to carry or a catch crop.

The Remedies.—It is useless now to say what ought to have been done in the autumn: we have to find remedies which will be valid at present. Two bad effects of high winter rainfall have to be met:—

(1) The effect on the clay, which shows itself in the bad state of the surface, and

(2) The depletion of the stock of soil nitrates.

The clay has to be flocculated once more, and this can be done by a variety of agents, including chalk, limestone, lime or soot. There is hardly time for chalk to act, and it is not certain that even ground limestone would work at this short notice: the choice is, therefore, reduced to lime or soot.

The loss of nitrate has to be made good. This can be done by a dressing of quick-acting nitrogenous manure: nitrate of soda, nitrate of lime, sulphate of ammonia, soot, or nitrolim.

It will be noticed that soot serves both purposes and is, therefore, well adapted for spring dressings—a fact that the

practical man has long since recognised. There is reason to suppose that both nitrolim and nitrate of lime would improve the tilth, though longer experience is necessary before expressing too definite an opinion. On the other hand, nitrate of soda does not improve the tilth but may in heavy soils make matters worse: later on, however, when the land is drier, this difficulty largely disappears, and it so happens that nitrate of soda can be put on later than the other manures mentioned here.

Apart from the question of tilth, the choice between these quick-acting manures is at present largely one of convenience, there being still time for any of them to act. In a short time the choice will be narrowed down.

The important thing, however, is that the nitrate supplies have been depleted by the winter rain and must be replenished unless this has already been done. Even in peace time the need of spring dressings would be great this year, and in present circumstances it is especially so. There are difficulties of transport and delivery of quick-acting manures, but it may be hoped that these will not prevent proper treatment of the crop.

FISH MEAL AS FOOD FOR PIGS.

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THE disposal of surplus fish and fish offal by conversion into dry meals has attained in recent years to the dimensions of a considerable industry at the larger fishing centres in the United Kingdom. Prior to the outbreak of war, almost the whole output of meal was exported to Germany, where it apparently found a ready sale. Now that this outlet has been closed, a special claim may be made upon the British farmer for a fair trial of the merits of this fish meal for feeding purposes.

In a previous issue of the *Journal* (Vol. XXI., p. 688, November, 1914) attention was directed to the nature, chemical composition and general feeding characteristics of fish meal, and strikingly favourable results obtained with pigs in comparative tests made at the Seale-Hayne Agricultural College in 1911-13 were quoted. Apart from these tests, however, little experimental work seems to have been carried out in this country with fish meal, and we are largely dependent upon Continental work for our information as to its relative merits in comparison with the feeding-stuffs commonly used. The special circumstances of the moment seemed to call for further work on this material,

especially as subsequent experiments made at the Midland Agricultural College, in which fish meal was used as an ingredient of a mixed ration fed in conjunction with dairy-wash, have given results which do not entirely bear out those referred to above.

A further test has, therefore, been carried out during the past year at the Manor Farm, Garforth (experimental farm of the University of Leeds and the Yorkshire Council for Agricultural Education), the results of which are given in the present article.

Twelve Large White pigs, ranging in age from 13 to 21 weeks, were divided into two lots as evenly as possible, each lot consisting of 3 castrated hogs and 3 gilts. In making up the lots attention was paid not only to age and live-weight but also to breeding, to ensure that each litter drawn from should be represented as uniformly as possible in each experimental group.

The animals were weighed weekly throughout the experiment, and at each weighing not only was the total weight of each lot ascertained, but the weight of each individual was taken as accurately as the weigh-bridge would permit (1-2 lb.), so that a rough guide as to the rate of progress of each animal was obtained.

The experiment was commenced on 15th June, 1915, and was continued until 17th November, thus covering a period of 22 weeks. Reasonable facilities for exercise in the open were given.

For the first 4 weeks each lot was given the same ration of bran and sharps. Fish meal was then (14th July) gradually introduced into the ration of Lot A in the place of an equal weight of sharps, the total supply of "meals" thus being kept the same for each lot.

Seven weeks later (1st September) the rations were gradually transposed, the fish meal being gradually replaced by sharps in the ration of Lot A, and introduced in the place of sharps in the ration of Lot B.

Seven weeks later (20th October) fish meal was again gradually substituted for an equal weight of sharps in the ration of Lot A, but was not removed from the ration of Lot B, so that for the last 4 weeks each lot received fish meal along with the bran and sharps, and for the last three weeks the rations were identical in every respect.

The general plan of experiment is summarised in the first table on the following page.

No milk, whey or dairy refuse was fed at any stage of the experiment.

It will be observed that the experiment consisted of a comparison of equal weights of sharps and fish meal, the latter forming from one-seventh to ...

dry food, and rising in the last month of the experiment to rather more than 1 lb. per pig daily.

Period.	General Character of Feeding.	Average Daily Ration per Lot of 6 Pigs. Lot A.	Lot B.
Preliminary Control Period (4 weeks, June 15th to July 13th).	Identical for both lots. (No Fish Meal.)	2·4 lb. Bran. 12·0 " Sharps. 72 " Water.	2·4 lb. Bran. 12·0 " Sharps. 72 " Water.
First Transitional Period (1 week, July 14th to 20th).	Fish Meal gradually introduced into ration of Lot A, in place of equal weight of Sharps.	3·0 lb. Bran. 13·5 " Sharps. 1·5 " Fish Meal. 90 " Water.	3·0 lb. Bran. 15·0 " Sharps. 90 " Water.
First Experimental Period (6 weeks, July 21st to Aug. 31st).	*Lot A.—Bran, Sharps and Fish Meal.* *Lot B.—Bran and Sharps.*	*4·1 lb. Bran.* *18·1 " Sharps.* *2·7 " Fish Meal* *107 " Water.*	*4·1 lb. Bran.* *20·8 " Sharps.* *107 " Water.*
Second Transitional Period (1 week, Sept. 1st to 7th).	Rations of lots gradually transposed.	5·8 lb. Bran. 27·5 " Sharps. 1·4 " Fish Meal. 139 " Water.	5·8 lb. Bran. 25·3 " Sharps. 3·6 " Fish Meal. 139 " Water.
Second Experimental Period (6 weeks, Sept. 8th to Oct. 19th).	*Lot A.—Bran and Sharps.* *Lot B.—Bran, Sharps and Fish Meal.*	*6·5 lb. Bran.* *32·5 " Sharps.* — *146 " Water.*	*6·5 lb. Bran* *27·1 " Sharps.* *5·4 " Fish Meal.* *146 " Water.*
Third Transitional Period (1 week, Oct. 20th to 26th).	Fish Meal gradually introduced into ration of Lot A. Ration of Lot B unchanged.	8 lb. Bran. 36 " Sharps. 4 " Fish Meal. 160 " Water.	8 lb. Bran. 33 " Sharps. 7 " Fish Meal. 160 " Water.
Final Control Period (3 weeks Oct. 27th to Nov. 17th).	Identical for both lots. (Fish meal included in ration.)	9·8 lb. Bran. 42·2 " Sharps. 7·0 " Fish Meal. 182 " Water.	9·8 lb. Bran. 42·2 " Sharps. 7·0 " Fish Meal. 182 " Water.

The composition of the fish meal used is given in the first column of the following table, together with the corresponding data for six other samples procured from different makers, the average for the seven samples being also included:—

	Sample.							Average (7 Samples.)
	No. 1.*	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture ..	11·6	12·3	12·7	11·5	13·5	14·6	13·9	12·9
Protein ..	52·7	51·1	56·9	56·3	61·3	55·4	57·1	55·8
Oil	6·7	5·5	3·2	4·8	1·3	3·1	2·3	3·8
Ash	25·3†	28·0	24·9	24·2	23·4	26·5	24·9	25·3‡
Including chlorides, expressed as common salt	2·6	0·6	1·4	1·9	5·3	2·1	1·8	2·2

* As used in the experiment.

† Including 9·46 per cent. phosphoric acid (P_2O_5).

‡ Including [illegible]

It will be noted that the fish meal used in the experiment contained rather less than the average proportion of protein ("albuminoids") and decidedly more than the average proportion of oil. This latter fact probably enhanced the feeding value of the meal, but at the same time, according to popular belief, would increase the risk of imparting a fishy taint to the carcass. The meal contained at most 2·6 per cent. of common salt, representing, in the highest allowance of fish meal used, a quantity of about ½ oz. of salt per pig daily. The supply of salt to pigs is commonly deprecated, but this amount produced no apparent ill-effects. Only one of the samples analysed (No. 5) contained more than this proportion, and was obviously very exceptional in this respect.

The average gains in live-weight for the different periods of the experiment are summarised below:—

AVERAGE WEEKLY GAIN IN LIVE-WEIGHT PER PIG (cf. TABLE, p. 31).

Period.	Nature of Feeding.	Lot A.			Lot B.			Average Difference in favour of Fish Meal.
		Hogs.	Gilts.	Average.	Hogs.	Gilts.	Average.	
		lb.	lb.	lb.	lb.	lb.	lb.	lb.
Preliminary Control Period (4 weeks).	Identical (no Fish Meal).	5·3	5·5	**5·4**	4·8	5·2	**5·0**	—
First Experimental Period (6 weeks).	Lot A.—Fish Meal. Lot B.—No Fish Meal	11·0	10·6	**10·8**	8·3	10·8	**9·5**	**1·3**
Second Experimental Period (6 weeks).	Lot A.—No Fish Meal Lot B.—Fish Meal.	10·3	9·0	**9·7**	11·5	10·6	**11·1**	**1·4**
Final Control Period (3 weeks).	Both lots receiving Fish Meal.	15·4	12·0	**13·7**	12·5	11·1	**11·8***	—

* This average is depressed by the abnormally low gain recorded in the last week, when two gilts, being *in œstro*, not only failed to gain in weight, but caused general disturbance of the whole lot. The averages for the preceding two weeks were:—Lot A, *14·4 lb.*; Lot B.—*14·7 lb.*

The records of the two control periods, in which there was no difference of ration between the two lots, indicate (see Footnote to Table) that the lots were as nearly equal as could be expected in view of the small numbers and mixed sexes in each. The differences between their records in the two experimental periods can, therefore, be reasonably attributed to the fish meal, which thus, as compared with sharps, effected an extra gain in live-weight of 1·3 lb. per pig per week on the average of the first experimental period, and of 1·4 lb. per pig per week on the average for the second experimental period—*or, for the two combined (12 weeks) an average gain of 1·35 lb. per pig weekly.*

The quantities of foodstuffs consumed and the average cost of the rations during the experimental periods are set out below:—

AVERAGE AMOUNT AND COST OF WEEKLY RATION PER PIG.

Food.	Lot A. Weight.	Lot A. Cost.	Lot B. Weight.	Lot B. Cost.
First Experimental Period.				
	lb.	Pence.	lb.	Pence.
Bran	4·8	3·50	4·8	3·50
Sharps	21·1	21·73	24·2	24·93
Fish Meal	3·1	3·49	—	—
Total	29·0	28·72	29·0	28·43
Second Experimental Period.				
Bran	7·6	5·55	7·6	5·55
Sharps	37·9	39·04	31·6	32·55
Fish Meal	—	—	6·3	7·09
Total	45·5	44·59	45·5	45·19

The Two Periods Combined (12 weeks).

	With Fish Meal. Weight.	With Fish Meal. Cost.	Without Fish Meal. Weight.	Without Fish Meal. Cost.
	lb.	Pence.	lb.	Pence.
Bran	6·2	4·53	6·2	4·53
Sharps	26·35	27·14	31·05	31·98
Fish Meal	4·7	5·29	—	—
Total	37·25	36·96	37·25	36·51

COST PRICES OF FOODSTUFFS.

	Per ton. £	s.	d.	=	Per lb. Pence.
Bran	6	16	4	..	·73
Sharps	9	12	6	..	1·03
Fish Meal	10	10	0	..	1·125

Taking the average for the whole 12 weeks covered by the two experimental periods, it will be observed that the use of fish meal, to the extent of practically one-eighth of the total ration, as a substitute for an equal weight of sharps increased the cost of feeding by barely ½*d*. per pig per week. In these calculations of cost the residual manurial values of the feeding-stuffs have not been taken into account. If these be allowed on

the scale suggested by Hall and Voelcker (see this *Journal* for January, 1915, p. 931), the fish meal ration becomes actually cheaper than the ration of bran and sharps, since the manurial value of the fish meal, if of the quality used in the experiment, is 88*s*. per ton,* whilst that of the sharps is but 29*s*. per ton.

LIVE-WEIGHTS AND GAINS OF INDIVIDUAL PIGS.

Period.	Lot A.						
	Hogs.			Gilts.			
	No. 328.	No. 338.	No. 355.	No. 329.	No. 331.	No. 334.	Average.
	Initial Live-weight.						
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
	38	48	39	71	57	41	49
	Average Weekly Gain in Live-weight for Period.						
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1st Control (No Fish Meal)	5·7	5·3	4·7	7·0	5·5	3·8	5·4±·3
1st Experimental Period (Fish Meal)	11·3	10·0	11·7	11·8	10·8	9·2	10·8±·3
2nd Experimental Period (No Fish Meal)	10·2	10·2	10·7	9·5	8·7	9·0	9·7±·2
Final Control (Fish Meal)	14·7	17·0	14·7	11·3	14·0	10·7	13·7±·6

Period.	Lot B.						
	Hogs.			Gilts.			
	No. 332.	No. 339.	No. 341.	No. 333.	No. 337.	No. 342.	Average.
	Initial Live-weight.						
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
	57	34	40	57	75	44	51
	Average Weekly Gain in Live-weight for Period.						
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1st Control (No Fish Meal)	6·3	3·1	5·1	5·1	4·8	·6	5·0±·3
1st Experimental Period (No Fish Meal)	10·5	7·3	7·0	10·0	12·7	9·7	9·5±·6
2nd Experimental Period (Fish Meal)	13·2	10·8	10·5	11·0	10·0	10·8	11·1±·2
Final Control (Fish Meal)	14·7	10·7	12·0	13·3	8·7	11·3	11·8±·6

Even if we leave out of account, however, these somewhat speculative estimates of manurial value and take into consideration simply the purchase prices quoted above, the fact that, on

* The *average* composition quoted on p. 29 would represent a manurial value of 90*s*. per ton.

the average, an extra 1·35 lb. of live-weight was obtained weekly for 12 weeks, at the trifling cost of barely ½*d.* per week, can leave no doubt as to the decided benefit which has resulted in this test from the partial replacement of sharps by fish meal.

The scale of the experiment is too small to warrant the conclusion being drawn that an equally profitable result would always be obtained, but the results, taken in conjunction with those of the Seale-Hayne experiments, do lend substantial support to the claim that fish meal is a valuable feeding-stuff for pigs.

There remained to be examined the possibility that the use of fish meal might have imparted an objectionable taint to the carcasses of the animals. In order to see if this were the case, one pig from each lot was killed and dressed on 24th November, one of the two having consumed fish meal daily for the last 11 weeks of its life, the amount exceeding 1 lb. daily for the last five weeks. In neither case could any exception be taken to the general appearance, colour or smell of any portion of the carcass. Portions of the carcass were submitted further to a cooking test with similar results. At no stage of the cooking could any exceptional smell be detected, and the flavour of the cooked meat, fat and lean, was above reproach. This is in agreement with the recorded experience of other experimenters with fish meal.

In conclusion, the writer acknowledges the co-operation of Mr. H. J. Hargraves, N.D.A., Farm Assistant for Nutrition Experiments, to whose skill in feeding and care in weighing the animals the practical success of the experiment is due.

PUBLIC ELEMENTARY SCHOOLS AND FOOD SUPPLY IN WAR TIME.

THE following "Memorandum for Teachers in Rural and Suburban Schools" has been issued by the Board of Education* :—

1. The Board of Education have been requested by the President of the Board of Agriculture and Fisheries to draw the attention of Local Education Authorities, school-managers, teachers, parents, and others interested in the work of elementary schools, to the need for maintaining and increasing the supply of home-grown food of all kinds. The Board are well

* Circular No. 944, 1916, price 1*d.* To be obtained from Messrs. Wyman & Sons, Ltd., Fetter Lane, E.C.; H.M. Stationery Office (Scottish Branch), Edinburgh; or E. Ponsonby, Ltd., Grafton Street, Dublin.

aware how much useful work has already been done in connection with the War by the elementary schools and they recognise the difficulties under which many schools are being conducted owing to the absence of teachers on military service. But they feel confident that every elementary school which is in a position to do so will be ready to assist at the present time in any work which can contribute directly or indirectly to the national welfare.

2. This Memorandum is limited to indicating briefly some of the minor industries and occupations for increasing food-supply which have been and can be taken up in connection with rural and semi-rural schools where circumstances are favourable. No attempt is made to give detailed suggestions for carrying them on. Such suggestions would have to vary widely in accordance with local conditions; and there are numerous publications—especially the leaflets issued by the Board of Agriculture and Fisheries—from which expert guidance in matters of detail can be obtained. The suggestions on gardening and winter gardening issued by the Board of Education† should also prove helpful.

Choice of Work.—3. Of the various branches of practical work already undertaken in connection with elementary schools several are directly concerned with the production of food, viz.: gardening; the keeping of poultry, pigeons, rabbits and bees, and, in a few schools, of pigs and goats; and (for girls in connection with cookery lessons) the making of jam, the evaporating and bottling of fruits, and the drying of savoury herbs.

4. Before deciding which, if any, of these or similar occupations can be profitably undertaken in any particular school, all the circumstances of the school should be carefully considered—especially the knowledge and tastes of the teachers; the soil and situation; the possibility of acquiring land with reasonable security of tenure; the cost of carriage; the prices of manures and feeding-stuffs, and the prospects of marketing the produce to advantage. If it is proposed to keep pigs or goats, accurate information should be obtained respecting the by-laws which regulate the keeping of animals near houses. In all cases it will be advisable to discuss the project with the owners or occupiers of neighbouring premises.

The sympathy and approval of the children's parents should also be sought; it may sometimes be possible to obtain their active co-operation.

† These publications may be obtained from Messrs. Wyman & Sons, Ltd., Fetter Lane, London, E.C. Price 1*d*. each, post paid 1½*d*.

Gardening.—5. In October, 1915, there were 3,129 school-gardens in England, in which 56,037 children of elementary school age were receiving instruction in practical gardening. Efforts will no doubt be made, by intensive cultivation and a well-arranged system of secondary cropping, to use every yard of land in these gardens to the best advantage throughout the year. Some general suggestions, however, may be made as to various methods of extending the use of school-gardening at the present time.

6. Wherever possible, more land should be acquired. In suburban districts the use of vacant building plots, which in many cases will not be required for building purposes during the period of the war, might often be secured at a nominal rental. Waste lands and derelict cottage gardens might be brought into cultivation. Various schools have already done good service by reclaiming rough pieces of land which the village gardeners have hitherto regarded as useless for horticultural purposes. In some cases, where the ground is heavy, farmers have been willing to plough it in the first instance.

The school garden-class might offer their assistance in the management, or even take entire charge, of some of the cottage gardens where the men are serving with the Forces or are giving up their spare time to other war work.

Any extra land is best devoted mainly to vegetables, such as potatoes, onions, carrots, turnips, parsnips and beet root, which can be easily stored for use in winter and early spring. As these crops are gathered, the ground should be planted with winter greens of all kinds.

7. If new land is to be taken, it is of course imperative that the work of trenching the ground should begin early, and that advantage should be taken of fine days in winter to push forward with the necessary digging, draining and fencing.

A dressing of lime will often be necessary for new gardens. The compost heap, including such materials as road sweepings (if free from tar or petrol), trimmings and household refuse, will prove useful for enriching the ground. Night soil can be used in some gardens for crops like onions, the cabbage family and runner-beans, when the supply of stable and farmyard manure is limited. The value of soap-suds as an aid to manuring in summer has still to be fully appreciated.

8. The school can sometimes be made a "centre" for simple seed-testing, for distributing plants of the varieties most suitable to the district, and for the economical purchase of seeds

and chemical manures. Chemical manures are often misused or used wastefully; and the school can do very useful work in helping to spread information published by the Board of Agriculture and Fisheries with regard to suitable manuring of various crops. In some districts the school can help to foster co-operation among rural workers. Some teachers have been very successful in organising the collection of eggs and poultry, and the purchase for joint use by allotment holders of useful but comparatively costly implements, *e.g.*, sprayers for potatoes and fruit, as well as in forming local clubs for the insurance of pigs and cattle.

9. In the management of a school garden at the present time there is special need for rigid economy in such matters as the thin sowing of small seeds, and the utilisation of thinnings, small potatoes, the trimmings of green vegetables, &c., as food for pigs, rabbits or fowls, where these are kept at the school or by neighbouring cottagers.

Work for Cookery Classes and Older Girls.—10. The Board have already drawn the attention of teachers of domestic subjects and others to the need for increased economy in the preparation of food, and have issued a pamphlet entitled "Economy in Food," setting out methods of preparing meals at a moderate price and of using vegetables as a substitute for meat.*

Many schools are so situated that it should not be difficult to establish a much closer connection than has hitherto existed between the school garden on the one hand and the cookery class on the other. It is not desirable that the regular courses of cookery lessons should be seriously disturbed; but it should be possible to give increased attention to certain aspects of the subject with a view, for example, to cultivating skill in the simple cooking of vegetables. More time also might be given to those branches of domestic work which in large households come within the province of the still-room maid but which are equally within the reach of the clever cottage housewife. These would include such work as:—

(*a*) Jam making from such cheap fruits as apples, rhubarb, gooseberries, damsons and vegetable marrows. In some places wild fruit, *e.g.*, blackberries, can be used. It will be necessary to watch the price of sugar carefully with this work; with juicy fruits glucose can safely be used as a substitute, and with other fruits also if care is taken to dissolve it previous to use.

* Obtainable from Messrs. Wyman & Sons, Ltd., Fetter Lane, London, E.C. Price 1*d*., post paid 1½*d*.

(*b*) Bottling fresh fruit in water. In a few cases girls might be taught how to evaporate such fruits as apples and plums.

(*c*) Making pickles and chutney. Young dwarf-beans and young carrots, onions and shallots, ridge cucumbers, red cabbage, cauliflowers and damsons may be mentioned as garden produce suitable for pickling, and gooseberries, marrows, tomatoes and apples for the making of chutney.

Keeping of Live Stock.—11. What the school can do in the way of keeping bees, poultry or other stock must depend mainly on the teacher. A teacher who has had no practical experience and must depend solely on printed books and publications for advice is very unlikely to make a success of any of these forms of work.

There are, however, a number of teachers in rural districts who have gained the necessary experience in managing live stock of their own and who, with local assistance, could turn their knowledge to good use in their schools.

Poultry Keeping.—12. *Poultry are probably the most convenient* live stock for school and cottage purposes; and perhaps the easiest and most profitable branch of poultry-farming is the breeding and management of a few fowls specially selected for winter laying.

It is, of course, desirable that fowls should have a free run, but they also do well in confinement if properly fed, cleaned, housed and sheltered.

There may be a few schools so situated that it would be profitable to breed and feed chickens for the table, which could be sold either direct to the consumer or to a poulterer. Both eggs and dressed poultry are likely to command good prices owing to the stoppage of the usual supplies from France and Russia. Teachers who are experienced poultry-keepers may be able to find opportunities for teaching the older children how to manage an incubator and foster-mother.

13. Occasional opportunities might be found even at schools situated in the midst of a considerable population for the practice of what is sometimes known as "backyard poultry-farming." It may be noted that for egg production it is not at all necessary in these cases to keep a male-bird with the hens.

In low-lying districts, where water and open ground are available, Indian Runner ducks may be kept in substitution for, or along with, fowls. They are good layers and find much of the food they need for themselves.

Rabbits.—14. In some parts of the country the larger varieties of tame rabbits are fed for table use. Where a market is at hand, they are profitable stock for the small-holder, as their food may consist very largely of kitchen scraps and the wastage of the garden, with such additional fodder as may be gathered along the sides of country lanes and hedgerows. Occasionally they are kept to crop small lawns and grass surfaces. Most country boys know a good deal about the feeding and management of rabbits as pets, and there would as a rule be no difficulty in establishing a "school rabbitry," where room can be found for their accommodation. It will probably be necessary in most villages to find a market for the rabbits in neighbouring towns, since local prejudice usually prevents the use of tame rabbits for food in places where wild rabbits are plentiful.

Bees.—15. A few years ago bee-keeping in connection with school-gardens was taken up by a large number of teachers; but the frequent losses of valuable stocks, due to "Isle of Wight" bee-disease for which no effective remedy is yet forthcoming, have tended to discourage bee-keeping all over the country. It is the opinion of experts, however, that, at least in some districts, the disease is showing signs of wearing itself out, and it may soon be possible to resume bee-keeping with good hopes of success. Bees are very profitable in districts where their food plants grow abundantly.

Pigs and Goats.—16. The keeping of these animals by school children is a much more difficult matter, and should only be attempted when circumstances are favourable.

The keeping of pigs has the advantage of providing a constant supply of manure for the garden. In most cases, however, neither pigs nor goats can be kept at school unless the local by-laws have been relaxed on account of the war. Further, in view of the present high price of feeding-stuffs, the school which is to make a profit must organise a systematic collection of kitchen and garden waste from the children's homes or from houses in the neighbourhood where no poultry or pigs are kept.

Work during Holidays.—17. The need for making special arrangements in order to keep the school garden in cultivation and to have the animals properly looked after during holidays should be borne in mind. As a rule the difficulty can easily be met through the goodwill of neighbours or the interest of the children themselves.

Handicraft.—18. In many districts the work of the school in increasing food supply can be helped by the Manual Instruction Centres and Classes. Many necessary appliances for the garden and livestock, *e.g.*, garden-frames, hand-lights, hand-barrows, weeding-trays, potato-boxes, fencing, &c., for the garden; and coops, nesting-boxes, feeding-troughs, bee-hives, &c., for the livestock, can easily be made at the Centres. In some schools tool-sheds, workshops, poultry houses, rabbit hutches and other comparatively large wooden structures have been erected cheaply and expeditiously by the boys themselves.

The Collection of Wild Fruits, &c.—19. Country school-children have always found employment in their spare time during the summer and autumn months in the gathering of mushrooms, whortle-berries ("wimberries" or "bilberries" in various counties), blackberries, &c., for sale and for home use, and in many districts the summer holidays are so arranged as to coincide with the gathering seasons. In the present emergency, however, there is equal need for the collection of acorns, horse-chestnuts and beech-mast as food for stock, as well as for the cutting and drying of bracken and of clean roadside grasses for litter.

Children should be reminded that the harvesting of these *wild products of field and hedgerow is important work; it* can be shared by all except the very youngest children in country schools.

If acorns and horse-chestnuts are gathered for pigs or cattle (not dairy cows) kept at school or at home, they should only be given to stock sparingly and with great discretion, after consulting someone of experience or the Board of Agriculture's Leaflet on the subject.

With the marked rise in the price of drugs the cultivation of useful herbs and the gathering on a large scale of others which grow wild are being revived. The flowers of camomile, the petals of the poppy and the flowering tops of yarrow, the leaves of the foxglove and the roots of monkshood and valerian, for example, are quite easy to collect in many districts.

Financial and General.—20. Teachers will naturally ask when all this practical work is to be done, and how the necessary capital is to be found. The following suggestions may be found useful:—

(*a*) The work will be done, as a rule, partly during school hours and partly in the children's spare time. In

suitable schools the time devoted in school hours to such subjects as gardening may properly be increased; if the work is carefully organised and allocated to the children according to a pre-arranged "rota," there should be no need for any child to spend a disproportionate amount of his school-time at work of the kind described in this Memorandum.

(*b*) The capital for starting such work as is discussed in this Memorandum is sometimes provided by the Local Education Authority; in other cases it is advanced by managers, teachers or others interested in the school, and its repayment (with interest thereon) by instalments is made a first charge on the income.

In some schools the children have formed societies on co-operative profit-sharing lines, the children and teachers being the only shareholders. It is not necessary that all the children who take part in the work should take up shares; some may be employed by the society, and when the dividend is declared a small sum is voted to them in return for their work.

Even if the children cannot be organised as a society they may properly be entrusted under the teacher's supervision with the care of the accounts. Without attempting the formal study of book-keeping a simple set of accounts can be kept, orders for goods can be written and stock-taking carried out at intervals.

Two Warnings.—21. (*a*) Teachers will need to impress strongly on the children the importance of getting through the outdoor work of the school in reasonable time. If children are allowed to loiter and "make a job last out," in order to escape indoor lessons, they will quickly acquire bad habits of indolence and more harm than good will result.

(*b*) All the practical work should be marked by scrupulous order, neatness and cleanliness. Tools and utensils of all kinds should be carefully cleaned every time they are used before putting them away in their proper places.

22. The following leaflets of the Board of Agriculture and Fisheries are recommended by them as especially useful for reading and reference in schools.*

* A long list of leaflets is given in the Memorandum, but cannot be reproduced here. A complete list of all leaflets may be obtained post-free, on application to the Board of Agriculture and Fisheries, Whitehall Place, London, S.W. Letters of application need not be stamped. The leaflets are gratuitous and post-free.

THE SALE OF HOME-GROWN WOOL.
Is the Present System Satisfactory?
Classed and Unclassed Wool.

DIGBY B. GRIST,

Wool Organiser for the Agricultural Organisation Society.

IN this article it is proposed to discuss the subject of the marketing of home-grown wool from the standpoint of the sheep farmer rather than from the standpoint of the buyer. It is hoped to show that the adoption of more scientific methods of sale by the farmer will result in benefit not only to himself but also to the manufacturer.

There are two main systems of selling wool in this country, viz., (1) by private treaty through dealers calling on the individual farmers, (2) by local auction. In each case the wool is prepared for sale in much the same way. The sheep are shorn and the whole fleece, including trimmings and often dags and other dirt, is wrapped up tightly, and generally tied and packed in large, loose sheets. Where wool is sold by private treaty there is practically no competition and the dealer fixes his own price. Where sale is through a local auction prices generally run a little higher, but often the competition is only nominal and the buyers agree on a maximum price. As a rule, very little attempt is made to trim the fleece and no grading or classing is done, with the result that prices are more or less averaged, and there is little prospect of the careful farmer receiving adequate reward for the extra pains he takes with his wool. The buyers in quoting naturally make their deductions for trimmings and dirt and do not offer the full ruling value of similar fleeces in best condition.

By way of contrast we may consider the methods adopted by sheep farmers in the Colonies. Sheep are run in large flocks and shearing machinery is in general use; the belly wool and trimmings are separated and the fleece is classed according to quality. The different kinds of wool are then baled and sent either to London for sale at the London Wool Exchange, or to one of the big Colonial wool sales in Sydney, Melbourne, Adelaide, Brisbane, or Wellington. At these sales the keenest competition is encountered and the best prices are realised.

The main difference between the systems lies in the fact that wool from the Colonies is classed and the Home wool is

unclassed. Can English farmers adopt the Colonial method and class their wool with advantage?

Before discussing the advantages of classing it is necessary to explain the process in some detail.

It is necessary to discriminate between "classing" and "sorting," as the word "sorting" is often used where only "classing" is meant. Classing is the first process to be applied to the fleece and is a work that any farmer, shepherd, or man of ordinary intelligence can do. Sorting, however, is a trade process that no one should attempt unless he has served his time to a wool stapler, wool merchant, or manufacturer who buys his own wool and sorts it for the different kinds of cloth he makes. To define these two processes further, *classing fleeces* merely means keeping the coarse from the fine, the long from the short, the dirty from the clean, and the heavy from the light. These four simple classings speak for themselves. Any average person can decide whether a fleece is fine or coarse, short or long, whether washed or unwashed, whether it is light in condition or heavy, and class it accordingly. The condition of a fleece is determined by the amount of natural grease yolk and earthy matter it contains. If deficient in these respects it will be dry and light. If these four simple points were borne in mind by the farmer when shearing he would see at a glance, by throwing the fleece on a table or bench, to which class it belonged, and at the same time he would be able to break off any hairy or dirty trimmings which might be adhering to the fleece. It is of the utmost importance to keep the *hairy leg and head trimmings* out of the fleece. These trimmings only amount to a few ounces and do considerable damage to the whole fleece when included; as they readily fall away from the fleece if shaken out after shearing it is no trouble to keep them separate. When they are kept out, a better price is given for the bulk, and the trimmings, if sold separately, command a good market, as there are merchants who only deal in this inferior wool.

The processes enumerated constitute *classing*, and any farmer will readily see that it takes no longer to do up wool in this way than in the way to which he has been accustomed, especially as there is no need to *wind* the fleece or tie it with string. All that is required is that the fleece should be neatly rolled up, with one end tucked in to keep it intact.

Wool sorting is another process altogether. It is the breaking up of the fleece into many sorts to suit the manufacturer, and *need not be touched upon here.*

The advantages of classing wool were recognised by Australian pioneers, and in the very early days of the Colony it was discovered that those who paid the most attention to this very necessary process obtained better average prices for their wool when sold on the London markets. The get-up of wool in Australia has passed through several stages. The original wool growers followed the custom of English farmers by washing the sheep in cold water. All wool that came from the Antipodes in the early days was treated in this way, and in the London catalogues the plain word "combing" was used to designate this class, all others having a prefix such as "greasy combing," "scoured combing," &c.

The extension of the sheep-growing industry from the coast and well-watered districts to the dry plains and pastures of the interior created difficulties, and at many stations it was found that sufficient water did not exist to wash the sheep thoroughly, so an experiment was tried in sending the wool to Europe in the grease. Manufacturers soon adapted themselves to the altered conditions, and eventually preferred the greasy wool to the washed, as it enabled them to treat the fleeces from the commencement and obtain better results by regulating the quantity of grease left in the staple. The change was also agreeable to the grower, as it saved working the sheep at the cold water runs (and sheep can never be worked in large numbers without loss), while at the same time it saved labour—a most important matter in a new Colony where men are scarce.

It was natural when all parties were in agreement that the days of washing wool were numbered, and at the present time out of the million and a-half or two million bales that come annually from Australia only a few hundred bales of exceptionally fine Merino wool come to London in a washed state. It is true this Merino wool realises extraordinary prices—up to 4*s*. or 5*s*. per lb.—but the sheep are so small and delicate and take so much looking after that they do not pay like the larger-framed and heavier-fleeced animals. Further, a certain amount of wool is scoured by scouring machines on stations long distances away from railroads to save expense in carting, but when practicable the wool is always sent in its natural condition.

The system of classing has been carried to great lengths on the larger farms in Australia, where from 100,000 to 200,000 sheep are shorn by experienced classers. It must be clearly understood that in large flocks the greater the number of classes into which the wool can be divided up the better, as

both here and on the Continent manufacturers specialise in certain qualities, and the nearer they can buy wool to the quality they want the more they will give for it. This should be borne in mind in trying to initiate a system of classing in this country. It may be better explained by stating that some buyers use only Lincoln wool, while others confine their operations entirely to Down sorts and hogg wool. Wether and ewe wool have also their separate admirers, so that it can be easily understood that when all kinds are sold to a dealer in bulk unclassed he gives an average price, and by classing the fleeces obtains the profit that might go to the farmer, who could easily have classed for himself.

As already indicated, the disposal of the skirting is most important. The system that prevails to a large extent in this country of rolling all skirts and ends in the fleeces is antiquated and pernicious, as it means that the buyer has to estimate the quantity of inferior wool which he cannot see. Naturally, this estimate is seldom to the advantage of the seller and must tell very much against his interest in the long run.

The London market is visited by buyers from all parts of the world, some to buy greasy wool, some to buy scoured, some to buy fine wools, some to buy coarse, and some who confine their purchases exclusively to pieces and locks. Surely, therefore, London is the best place to offer wool, and it is worth while to offer it in a condition to meet the demands of the market. It is a market where the man who takes the greatest care in the breeding of his sheep and the get-up of his wool obtains the highest prices, and where competition instils into growers the spirit of emulation which is so necessary in obtaining the best results.

Buyers from all over the world congregate at the great wool sales which are held six times a year at the London Wool Exchange in Coleman Street. Here also wool is sold from nearly all the most important wool-producing countries. Wool is sent, for instance, from New South Wales, Tasmania, Queensland, Victoria, West and South Australia, and New Zealand, from the Cape of Good Hope, from the Falkland Islands, from the Argentine, from Chili, and from Peru. This wool is all packed and graded upon the same lines, and the largest buyers compete for its purchase, because on the London Wool Market they have the best opportunities of getting the kind of wool they want and in the quantities in which they want it.

So much for classing in the Colonies; but can the English farmer with his smaller flocks class his wool with a prospect of sufficiently increased returns to compensate for the extra expense involved ?

The answer to this question is in the affirmative, but with the proviso that if the fullest benefits are to be obtained from the new system farmers must co-operate. This can be done quite simply by the formation of a co-operative wool society registered under the Industrial and Provident Societies Act, the sheep farmers themselves forming the members of the society, and managing their own affairs. Guidance and assistance in regard to the formation of such societies can be obtained from the Agricultural Organisation Society, Queen Anne's Chambers, Tothill Street, Westminster, S.W.

The farmers of a district, by combining, can ensure the collection of sufficient wool to make worth while the employment of an expert classer, and the placing on the market of sufficiently large lots of classed wool to attract the attention of the market, and create competition in buying.

The formation of a society with membership restricted to the sheep farmers themselves presents little difficulty. The share capital may be small provided it is sufficient to cover the cost of bales, a simple hand-press, weighing machine, and wages, etc., until the wool is sold. A depot for the receipt of the wool can be hired at a small cost for the few weeks in which it will be wanted, and the services of an expert classer can be secured for the period necessary to class the wool. London brokers are prepared to sell wool dealt with on these lines on a 10 per cent. sample of the bulk.

The first wool to be sold in this new way was 93,071 lb., sent up from Yorkshire in 1914 by the Brandsby Agricultural Trading Association for sale in London. This wool realised £4,521 7s. 2*d.*, a result which pleased the senders, who believe that, compared with local prices, the lower and medium grades realised quite as much, if not more, and the higher grades considerably more. The London papers reported favourably on the get-up and sale of the wool. Some of it went to France, Germany, and America, and some of it was bought by Yorkshire manufacturers at a higher price per lb. than that which was given by the dealers who, at the same date, were purchasing wool from the farmers in Yorkshire. The actual expenses of the Brandsby scheme in 1914 (exclusive of management) amounted to £187 3*s.* 11*d.*, or approximately ½*d.* a lb. The farmers, however, charged themselves an eighth of a penny

more per lb., and this left a balance sufficient to cover the expenses of management and to allow a small profit to the society. The principal items of expenditure were for labour, bales, and twine, and for brokers' charges.

At the same sale a small quantity of wool under the mark of St. Giles was offered by tenants on the estate of the Earl of Shaftesbury in Dorsetshire, and the result was a surprise to the farmers who risked their wool for the first time away from the local fairs, as the best of it obtained 1*s.* 4½*d.* per lb., whereas the highest local price was 1*s.* 2¼*d.*

Hampshire was also represented at the sale, and one of the senders writes that, after allowing for all expenses, he made at least 1½*d.* a lb. more than he would have made locally. He adds: "Needless to say, next season my wool will be sold in the same market, and I think not a few of my county farmers will follow suit."

The members of the Carnarvonshire Wool Society have also come to recognise the value of this method in disposing of their wool. During June and July of 1914 a series of tours was made in the county by the Secretary of the Carnarvonshire Wool Society, and a large quantity of wool was promised to the Society for sale. When the war broke out, owing to rumours to the effect that there was likely to be a slump in the price of wool, there was a tendency on the part of those who had promised their wool to the Society to hold it back. To the experts it was evident that these rumours were unfounded, and meetings were immediately called to apprise the wool farmers of the real state of affairs, and these meetings produced the desired effect.

From the Lleyn and Bangor districts wool to the amount of 13,845 lb. was offered for sale on the London Wool Market on October 9th, 1914. It realised £756 3*s.* 8*d.*, the best sorts making up to 1*s.* 5*d.* per lb. The success of the sale may be judged from the letters of the owners of the wool. One of them writes: "Wool similar to ours is selling for 10¼*d.* per lb. here, the ordinary mountain wool is making 10*d.*" Another farmer, after he had received the sale accounts, wrote that when all expenses were deducted he considers he obtained 1¾*d.* more per lb. for his wool than it would have made had it been sold locally.

A certain number of small farmers, who had not been convinced as to the advisability of selling at the October sales of 1914, upon hearing of the success of the scheme, arranged for their small clips to be offered at the next sale in November.

This wool, comprising 2,881 lb., also sold with pleasing results, realising £163 4*s.* 10*d.*

It will be seen, therefore, that these experiments established the fact that the sheep-breeder may expect to market his wool upon the most favourable terms when he adopts the methods which have proved so advantageous in the case of his competitors who send their wool to be sold in London. The year 1915 saw a further extension of the movement for the direct sale of wool by farmers on the London market. Owing to the abnormal conditions produced by the war it is difficult to make a comparison of the prices obtained last season in London under the new scheme as against the prices ruling in the local markets, but most of those who adopted the new method have determined to do so again in 1916, and there are indications that the farmers in other districts will sell their coming season's crop in London under the new conditions.

Other advantages which result from the new system of marketing may be summarised as follows :—

1. No trouble and irritation are caused by deductions, such as deductions for blacks, cots, sheet hire, wrong description of hogg and ewe, luck money, etc. The result of such deductions in local marketing sometimes is that in the end the farmer finds it difficult to arrive at the price he really got.

2. The farmers are certain to obtain payment for their wool within 14 days after the sale. Further, if they desire to have part of their money at the time when they take their consignment to the local depot their society can arrange with their banker to advance two-thirds of its value.

3. The farmers also know that owing to the keen competition for wool which always obtains on the London Wool Exchange their wool will fetch its full marketable value.

These are benefits which the farmer often appreciates almost as much as an actual rise in prices.

TWO NEW SEEDLING HOPS OF COMMERCIAL PROMISE.

E. S. SALMON,

Mycologist to the South-Eastern Agricultural College, Wye, Kent.

IN 1906 the writer commenced to raise new varieties of hops from seed obtained by artificial and by natural cross-fertilisation, and at the present time the Experimental Hop-garden

at Wye College contains nearly 4,000 "hills" of seedling female hops and selected male hops. The commercial value of the most promising of the seedlings is now being tested, and it seems desirable to describe the characteristics of two seedling hops which appear worthy of more extended trial by the hop-growers of this country.*

One of the aims of these breeding experiments is to produce new varieties of hops possessing the true "Golding" flavour (so desirable for "dry hopping") combined with a stronger "constitution" than that shown by the varieties of "Golding" hops at present cultivated. This more vigorous constitution, which may reasonably be expected to appear in new varieties of seedling origin, would perhaps enable the plant to produce bigger crops, and to withstand better both the repeated "washings" which the grower is obliged to give the plant in years of persistent "blight" (*Aphis* attack), and the effects of a wet or otherwise unfavourable season. Many of the existing "Golding" varieties are so liable to fail in vigour of "constitution" that their growth is being discontinued in favour of varieties with less delicate flavour, but of stronger growth.

(1) The first new seedling hop to be described was raised in 1906 by "crossing" the variety "White's Early" with pollen obtained from an English male hop growing in a garden of the "Early Bird" variety, on Mr. Alfred Amos's farm at Wye, Kent. The variety "White's Early" produces hops with a delicate "Golding" flavour, and Whitehead† says of it: "White's Early Golding is a hop possessing the highest qualities, but it is not a large cropper." It is thus described by Professor J. Percival‡: "In quality, this is one of the best, if not the best, early hop grown. Of medium size, rather thin in petal, and of a beautiful pale-golden colour, and excellent flavour. It closely resembles the Canterbury Whitebine variety, but is peculiar in having the petals loose and open at the tip. The bine is pale green; the plants are delicate, and rarely give a satisfactory crop."

The "cross" was effected (with control shoots) in July, 1906, the result being that on 30th August 28 hops, each containing from 3 to 22 seeds, were gathered from the pollinated

* In this *Journal* for May, 1915, attention was drawn to a new hop, the "Foundling," which is resistant to the "eelworm disease," and shows other characters of commercial importance.

† Trans. Inst. of Brewing, Vol. iv., 58 (1890–91).

‡ *Journ. Roy. Agric. Soc. England*, Vol. 62 (1901), p. 76.

FIG 1.—A branch of the "Young Hopeful" Hop.

FIG. 2.—"Young Hopeful" Hops; natural size.

branches, and 34 hops, all without seeds, from the "control," or unpollinated branches. The seeds were sown in 1907; some germinated at once, but others not until 1908. Nineteen of the seedlings were potted up, and in 1909 planted out in the Experimental Hop-garden. Of the 19 seedlings, 9 were females, 3 males, and 7 permanently dwarf and sterile hops. Two of the females were of no commercial promise, and the remaining 7 have been kept under close observation for the past 7 seasons. While they differ among themselves in such characters as degree of vigour of growth and cropping powers, length of the laterals, and size and density of the hop, they *all* show a general resemblance to "White's Early" in earliness, in the large, bold, rather open, hops with thin "petals," *and in possessing the delicate "Golding" flavour.**

Two, if not three of the seedlings, show promise commercially; only one of these, however, has yet been tested sufficiently. This seedling (Ref. No. 125) shows the following characters:—An Early Hop (in season about the same as Amos's "Early Bird"); growth strong, fruitful, sometimes forming a "crown" of hops, laterals short, rather closely set, hop ovoid, broad, with rounded tip, golden when ripe, of moderate density. (Photographs of a branch of hops, and of separate hops (natural size) are reproduced in Figs. 1 and 2). For several seasons box samples have been dried and submitted to experts in the Borough (London) and elsewhere. The reports obtained are as follows:—1910, "comes second to No. 38, has first-class flavour, quite equal to "White's Early" (*Factor A*).† 1911, "of inferior, not Golding flavour" (*Factor A*); "much the best of Nos. 34, 38, 41, 49, 54, 125—being a nice, thick hop, and certainly a Golding. All these hops are marketable hops, all have a Golding flavour, though not very pronounced, and all are certainly Goldings," (*Factor B*). 1912, "I place No. 54 first, with a very mild, true Golding flavour; and No. 125 second, with very similar, but not so mild a flavour, which has a little twang in it, though nothing to matter" (*Factor A*); "I place No. 54 first, and Nos. 125 and 34 equal for second place" (*Factor B*). 1915, "a nice hop, with a mild, Golding flavour—a better hop than Cobb's Golding" (*Factor B*); "a very nice, mild flavour, suitable for 'dry hopping'" (*Brewer J*).

* In many of the "crosses" made the resulting seedlings do not resemble the female parent. Thus in two crosses which have been made with the Fuggles none of the seedlings produce hops of the Fuggles type.

† The same letter designated the same judge in the different seasons.

Chemical analyses, using the Bryant and Meacham process (slightly modified),* to ascertain the percentage of soft resins, have been made, in different seasons, of box samples of No. 125, and of other hops of the same parentage. The figures obtained are as follows :—

Reference No.	1908.	1909.	1910.	1911.	1912.
	per cent.	per cent.	per cent.	per cent.	per cent.
125	—	—	8·66	8·66	10·30
34	—	—	—	7·26	—
38	9·95	—	7·27	8·82	—
41	—	—	—	9·15	—
49	—	—	9·22	7·17	—
53	—	12·89	10·65	—	—
54	—	—	9·72	8·63	7·68

"Cuts" of No. 125 have been sent for trial during the last 3 years to hop growers in 11 parishes in Kent, and one parish in Surrey. Where the hop has become established, favourable reports as to the growth have been received. On one farm in East Kent during the past season box samples were dried, and sent to the Borough for opinion as to flavour, etc., together with samples of the new seedling hop (No. 350), described below, and of the "Tutsham" variety—all grown on the same farm. The Factor's report was as follows :—"I find the flavour of all excellent. Perhaps Nos. 125 and 350 are the best, but I can detect no real difference in the flavour of these and of the Tutshams. They are very attractive-looking samples, and one or two of my customers want the offer of the hops."

The name of "Young Hopeful" is proposed for this new hop—the first to be described of the seedlings raised at Wye College.

(2) The second new hop, which appears to be of commercial promise, was raised in 1908 from a seed collected from a certain hop (Ref. No. D. 5) in the Experimental Hop-garden at Wye College—the male parent being unknown. The female parent (D. 5) was of unknown origin, but was believed to be a seedling ; it showed the following characters :—Early to mid-season, growth very vigorous, very fruitful, hop very large, oval, nice shape, dense, often with a tinge of red on the petals. A box sample was dried in 1907, and pronounced to have "an excellent flavour" (*Factor A*), "a good flavour" (*Factor E*). In 1910 the "hill" was attacked by the "eelworm disease," and was grubbed up.

* See *Journal of the South-Eastern Agricultural College* (Wye), Vol. xix, 1910, p. 375.

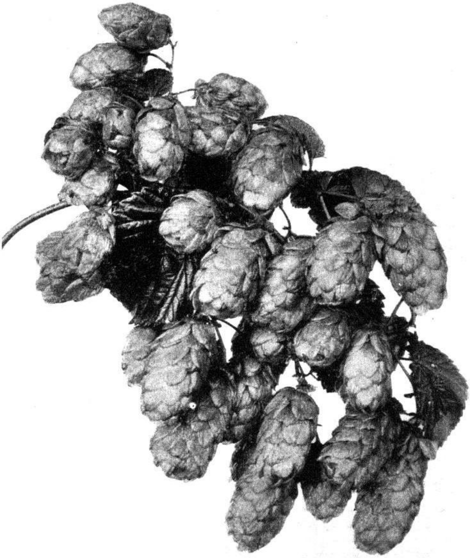


FIG 3.—A branch of the "Picker's Delight" Hop.

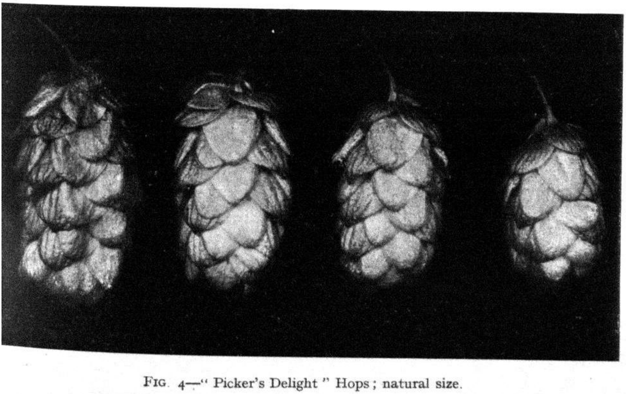


FIG. 4—"Picker's Delight" Hops; natural size.

The seedling (Ref. No. 350), which was planted out in the Experimental Hop-garden in 1910, shows the following characters :—Season early, a little later than "Amos's Early Bird"; vigorous, and very fruitful (from 1911 to 1915); laterals medium to short, hops densely clustered; hop large, oblong to cylindric, broad, sometimes slightly furrowed, dense, not Golding in character; strig green; hop golden when dead ripe. The hops often show a tinge of red on the lowest bracts, particularly in the case of the hops on the lowest laterals, and on young plants. (Photographs of a branch of hops, and also of separate hops (natural size) are reproduced in Figs. 3 and 4). The opinions on dried box-samples each season from 1911 to 1915 have been as follows :—1911, "common, inferior, coarse flavour" (*Factor A*); "does not stand out" (*Factor B*). 1912, "fairly strong flavour; poor 'condition'" (*Factor A*); "not enough flavour" (*Factor B*). 1913, "rank flavour—definitely not a Golding flavour" (*Factor A*); "I like this hop, distinctly a Golding flavour; good 'rub'" (*Factor B*); "good quality; peculiar flavour; good rub; is the best early hop of yours we have seen" (*Merchant D*). 1914, "very good hop; no objection to the flavour, but it is not Golding" (*Factor A*); "a good flavour—good enough for East Kent" (*Factor B*); "a good hop" (*Merchant D*); "has true Golding aroma, and is suitable for light and best bitter ales; sample superior to one of a good Mid-Kent Golding" (*Brewer I*). 1915, "flavour quite as good as Cobb's Golding, fair rub" (*Factor A*); "this is a good hop, with Golding flavour" (*Factor B*); "a hop with a silky 'rub,' of good size, and with a nice flavour, resembling our best Goldings; suitable for use for the most delicate pale ales" (*Brewer K.*)

The large size of the hops, densely clustered on the laterals, makes this an easy hop to pick; it is, therefore, proposed to name it "Picker's Delight." This hop is now being grown experimentally in 12 parishes in Kent, and in 2 localities in Surrey and Sussex.

Both the new hops described above can be seen growing in the Experimental Hop-garden at Wye College, and at the Fruit Research Station, East Malling, Kent. Hop growers in Kent, Surrey, or Sussex can obtain "cuts" free of charge on application to the Secretary, S. E. Agricultural College, Wye, Kent. Hop-growers in other counties can obtain sets from those farmers in Kent, Surrey, or Sussex, who are growing these varieties, a list of whom will be forwarded on application to the College.

CO-OPERATIVE FARM IMPLEMENT SOCIETIES—(*continued*).

T. WIBBERLEY, N.D.A., N.D.D.,

Agricultural Expert to the Irish Agricultural Organisation Society.

Threshing Machinery.—The writer has recently been engaged in giving lectures on Co-operative Implement Societies throughout England and Wales, and concludes that co-operation on the lines indicated appeals very much to the bodies of farmers addressed. The great shortage of agricultural labour, the present high prices of agricultural produce, and the genuine desire on the part of the English farmer to do all that is humanly possible to increase the nation's food supply, have undoubtedly resulted in the subject receiving more attention than would otherwise be the case.

A number of circumstances, taken together, have in many cases tended to delay threshing operations. As will be readily understood, the small farmer has suffered most in this respect. It is only reasonable to expect that the owner of a steam threshing plant prefers to undertake a contract with a large farmer, who will engage him for several days, rather than with a small farmer, who will only require the plant for a few hours. Many cases have been met with in which the small farmer had not been able to thresh his corn, and in one or two cases threshing "on the barrel," or with a flail, had been resorted to in order to provide corn for the immediate requirements of the farm. This is a very serious matter, and necessitates a most uneconomical use of manual labour, with the possible neglect of important farming operations in connection with the year's crops. In a few instances, where small farmers had been able to hire a steam threshing plant, they had been compelled to fit in the threshing of their corn to suit the convenience of the owner of the plant, and, lacking granary accommodation, had to dispose of their crops earlier, and at a lower price than they wished. Some of these men had intended to consume their corn at home, but were compelled to sell, and consequently to purchase maize meal, and other foreign feeding stuffs.

Different Types of Threshing Machinery.—There are many different types of threshing machines in use amongst the Co-operative Implement Societies in Ireland. The types of thresher used vary, in size and description, from the ordinary 6 to 8 nominal horse-power steam engine with 4 ft. 6 in. or

5 ft. high-speed drum, and costing from £800 to £1,000, down to a small portable petrol engine, and a small thresher, which can be hauled about from farm to farm by a donkey.

(1) The little plant, including engine, belts, pulley, and thresher, costs about £34, unmounted on wheels, and an extra £5 if provided with wheels, and draught rod or pony shafts.

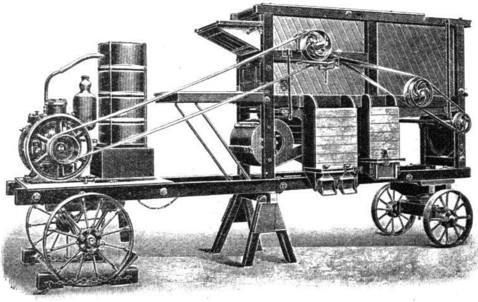
This type of machine is only of use for very small farmers, who have only a few acres of land with 1½ or 2 acres of corn at the most. The thresher is fitted with a steel pegged drum about 14 in. wide, and a single small fan. It will thresh about 80 bush. of oats in a day. The fan blows out the very light corn, cavings, and chaff; but the main bulk of the corn needs to be winnowed afterwards, unless it is intended for home consumption. Small as this little plant is, it is very useful for the type of small holder indicated above, whose only alternative for the threshing of his corn would be hand threshing with the flail.

(2) A more useful type of portable thresher for small farmers is one consisting of a small thresher with an 18 in. semi-high-speed steel pegged beater drum. This is fitted with an adjustable concave or breast, crank shakers, a fan, and riddles of different sizes. The riddles are interchangeable for the different types of corn—wheat, barley, oats, beans—which are to be threshed. This machine threshes the grain fairly clean, delivers it at side spouts, and also separates the small growing light grain and chaff from the general bulk; but does not separate the good corn into "firsts" and "seconds." Where it is desirable to do this the threshed corn is passed a second time through the machine, the speed and fan draught being increased. The "first" corn is then delivered at the main spout, and the "seconds" at the outlet, where, in the original threshing, the light stuff and rubbish are delivered.

This thresher was originally supplied mounted on four wheels with a lock front or pair of horse shafts or draw-bar. It was driven by a small engine, also mounted on its own wheels. The engine and thresher being on separate platforms, there was a great loss of power, through "belt slips," especially if the threshing was done in the field—the narrow wheels very soon cutting into the land with the vibration. At the suggestion of the writer, the makers remodelled the plant, building both engine and thresher on one platform. This arrangement, since any oscillation is "sympathetic" (*i.e.*, both engine and thresher oscillate in unison), reduces "belt slip" and loss of power to a minimum. In other words,

the plant has all the advantages of a stationary plant, and is still portable. Further, there is no loss of time in resetting the plant, or in lining up (getting engine and thresher pulleys in "plumb"), when the plant is removed. The platform is made telescopic, for transit purposes, the total length closed being 13 ft. (see illustration below).

The engine used is of 5 B.H.P., with direct magneto ignition, *i.e.*, the ignition passes direct from the magneto, through a high tension wire, without the use of a storage battery, accumulator, or coil, all of which are confusing to an unskilled operator, and are liable to give trouble even in the hands of a mechanic. The engine requires a very small amount (about half a wine glass) of petrol to start it, and after one



Small Thresher and 5 B.H.P. Engine, mounted on a Telescopic Platform, with 18-in. Drum. Very suitable for small holders.

or two firing strokes it will continue working on paraffin. The engine is water-cooled, a tank holding about 40 gal., and operating on the thermo-syphon system, being used for the purpose. The engine is also fitted with a special bottle-shaped silencer, so designed that there is little risk of igniting the contents of the stack yard from "back fire" of the engine.

The plant is easily removed from farm to farm by one heavy or two light horses. It is capable of threshing from 150 to 200 bush. of oats per day, at a cost of about 3*s.* 6*d.* for paraffin and lubrication. The complete plant costs about £90.

The thresher can be removed from the platform, and a corn-crushing or grinding mill, or a small flour-grinding mill, or a chaff cutter, etc., can be fitted in its place, and this may

FIG 1.—20 B.H.P. Motor driving a 4 ft. 6 in. Drum Thresher with Straw Elevator.

FIG 2.—6 to 8 B.H.P. Portable Oil Engine driving medium-size Thresher.

usefully be done after the threshing of the society has been completed. The fact that the engine can be used for all these various purposes makes for great economy. An engine depreciates as much when idle as when in use, while when it is idle the money invested is bringing in no return. These advantages, however, are insignificant compared with others which may result from the possession by a society of the various machines mentioned. In Ireland corn mills are very scarce, and facilities for the storing of ground oats, corn, or flour in quantity are often lacking, but when the grinding and milling of corn can be done with a society's plant, there is no need to grind a large bulk at a time. In like manner, very few small farmers having an engine of their own, the society's machinery will enable them to have a supply of fodder, sufficient for, say, a fortnight, chaffed at a time, so that there is no necessity for each farmer to possess a hand chaffing machine. It will be seen that the possession of a power thresher, a crushing and grinding mill, and a chaff cutter results in an economy of capital expenditure, an economy of labour, and often in an economy of material, since by chaffing much fodder can be used on a farm, even furze (which is very nutritious when chaffed), which cattle would refuse when in the long state.

(3) The next size of threshing plant, which is recommended, and the one most commonly purchased by farmers having from 6 to 12 acres of corn, is made on similar lines to the foregoing, but is stronger. The drum, moreover, is wider, being 24 in. wide. It is also fitted with a double blast arrangement for more effectively cleaning the corn, which it separates into "firsts" and "seconds." This machine, when desired, can also be fitted with a barley awner, or cobber, for removing the awns from the bearded or awned varieties of cereals. To drive this machine effectively, a portable oil engine of from 6 to 7 B.H.P. is used. The most common type of engine has a blow lamp ignition. The heavier work requires a good cooling system, and on the type of engine most commonly used the cooling is accomplished by a combination of the thermo-syphon principle, circulatory pump and radiator. The engine runs on paraffin.

This plant requires three horses for its transport, although two suffice in a level country. It is capable of threshing from 250 to 300 bush. of oats per day, at a cost of from 4*s.* to 5*s.* per day for lubrication and paraffin.

The cost of the complete plant is about £170, including belting, pulleys, tools, wheel chocks, etc. (See Fig. 1.)

(4) If a society desires a threshing plant capable of threshing more corn than the one just described, it might usefully purchase a plant consisting of a small agricultural tractor with a suitable thresher. The type of tractor is described in a previous article.* It is a 10 B.H.P. tractor capable of driving a thresher with a 36 in. to 39 in. high-speed drum. The high-speed drums are not of the type previously described, but have what are known as beater or rubbing drums. Instead of consisting of steel pegs projecting from a semi-wooden framework, they are made of steel throughout, steel bars with ribbed surfaces taking the place of the projecting pegs. A rotating screen is also used, in addition to the riddles, for the grading of the corn, which is also more thoroughly cleaned, separated, and delivered as " firsts," " seconds," and " thirds." This type of thresher can also be fitted with a cobber or awner. The distance between the drum and concave can be varied, so that all types of cereal grains, as well as peas and beans, can be threshed with the machine.

In addition to driving the threshing machine, the small motor is capable of hauling the thresher from farm to farm, and when not required for threshing, is available for general farm work and road hauling. This type of plant is capable of threshing 500 bush. of oats per day, at a cost of about 5*s.* per day for fuel (paraffin), and lubrication. The cost of the complete plant is about £290.

Apart from their low initial cost, when compared with the ordinary steam-threshing plant, the small and medium-sized threshing outfits possess many advantages for the small farmer. They require much less skill in manipulating, and a smaller team of men for threshing; no damage is done to headlands and roads; the threshing can be done to suit the convenience of the members of the society, and, above all, the cost of threshing is very much lower than when a steam thresher is hired. The last point is worthy of close attention. It appears that the hiring rate for a steam thresher, including the cost of coal supplied by the farmer, is about £3 per day. Where a complete day's threshing can be accomplished, a steam plant will thresh about 800 bush. per day. The cost of threshing 1 bush. is, therefore, 0·9*d.* In the case of the farmer with insufficient corn to provide a full day's threshing, however, the cost is proportionately higher, often reaching 1½*d.* per bush. The cost of threshing

* See this *Journal* for September, 1915, p. 570.

with the different types of plants described above can easily be calculated by adding to the cost of fuel and lubrication stated above about 5*s.* per day for the services of the engine driver—a skilled mechanic is not necessary—and 2*s.* per day to cover cost of depreciation. On this basis the cost of threshing 500 bush. of oats with the light motor plant referred to will be 12*s.*, or approximately 0·29*d.* per bush. In other words, compared with the cost of hiring, there would be a saving to the society who owned one of the plants of at least £1 5*s.* 6*d.* per day. Since the complete plant costs £290, the net saving in 228 days' threshing would therefore be sufficient to pay off the initial cost of the complete plant. A similar calculation may be made from the data supplied with the other types of threshers described.

(5) A society which undertakes the purchase of a 20 B.H.P. tractor usually consists of big farmers who grow a considerable amount of corn. Such farmers require a bigger type of thresher than the foregoing, and usually purchase a machine with a 4 ft. 6 in. or 5 ft. drum, of the same type as is generally used with the ordinary steam-threshing plant. This type of thresher is too well known to need any description here. Reference, however, may be made to the fact that the 20 B.H.P. motor is easily able to drive a thresher, even of the high-speed type, with a drum of the size mentioned above, and, in addition, where necessary, a straw trusser, or elevator. The motor, having a haulage capacity on the road of from 4 to 5 tons, is quite capable of transporting the thresher from farm to farm. The cost of such a plant will vary from £350 to £500. The plant will thresh, on an average, 800 bush. of oats per day, at a cost of 5s. or 6s. per day for lubrication and fuel (paraffin). If much road work is to be undertaken with these heavy type motors, either in the transporting of the thresher or general road hauling, it is very necessary to have well built and good strong wheels. In such a case also the axles of the motor, both in front and rear, should be spring mounted, or the motors will not stand much road work. Whilst it is a decided advantage to have spring-mounted axles on a motor for road work, the spring mounting, of the rear wheels at least, is a decided disadvantage when the motor is working on the land. This is a matter well worthy of the attention of motor makers. It should not be a difficult matter to fit chocks between the axles and body of a motor to prevent the springs operating when doing work on the land. Farmers who purchase a motor, either individually

or for joint use, require an all-round implement to work either on the land or on the road. (See Fig. 2.)

A Novel Method of Trussing.—As a rule small or large farmers in Ireland do not trouble to truss or bind the straw as it comes from the thresher, but stack it in the loose state. Wherever it is desired to truss and bind the straw, instead of going to the expense of purchasing a special straw trusser, the ordinary corn binder will serve the purpose if used with the small and medium threshing plants. This machine is mounted on its transport wheels, and placed with the platform canvas under the straw outlet of the thresher. A suitable pulley is fitted to the binder axle, which operates the sheafing and tying apparatus. This is driven from another pulley generally fitted on to the shaker axle of the thresher. As the straw falls on to the platform canvas, it is passed through the binder and trussed and tied just as when cutting corn. In order to economise twine, the sheaves are made much larger than corn sheaves, and as the straw is dry, this is easily possible.

MANGOLDS OR SWEDE TURNIPS FOR DAIRY COWS.*

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THE time when swede turnips were regarded by Danish dairymen as unsuitable food for dairy cows has long since passed away; the risk of imparting a bad flavour to the butter, popularly called "turnip flavour," disappeared as soon as the pasteurisation of milk became general. Since the advent of pasteurisation, the use of swede turnips as a food for dairy cows has been steadily extended in Denmark. In 1881, the total area under roots, including sugar beet, in that country was 50,000 acres; in 1912 the total area under roots, excluding sugar beet, was 650,000 acres; an increase of 600,000 acres in the course of 31 years.

Every Danish dairyman is convinced that roots are an indispensable constituent of an economic ration for cows. A ration without roots involves possible loss; on the other hand when roots can be added to the ration in liberal quantities the cost of the ration is reduced to a minimum, and a maximum

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* Based on experiments described in the 89th Report of the Danish State Experimental Laboratory: "Feeding Experiments with Dairy Cows."

profit is obtained. Hence the Danish practice of sowing a statute acre of roots for every three adult animals in the dairy herd.

In the 'eighties the nutrient value of swede turnips was popularly estimated to be less than that of the favourite Danish mangold known as "Barres * mangold"; later on, when the State collected annual analyses of roots of all kinds from different parts of Denmark for the guidance of dairymen, the percentage of dry matter or solids† found by analysis in roots, came to be regarded by dairymen as the decisive factor in estimating their relative nutrient values.

The following table will serve to illustrate the practical utility of Danish root analyses :—

Name of Roots.	Weight of Solids per acre:		Difference per acre between best and worst strains:		Average content of Solids.
	in the best seed-strains.	in the worst seed-strains.	in weight.	in value.	
	Cwt.	Cwt.	Cwt.	£ s. d.	per cent.
Mangold "Barres" ..	71·6	55·6	16·0	4 9 0	13 —14.5
,, "Eckendorfer" ..	57·0	48·2	8·8	2 5 6	11.5—12.5
Swede Turnip "Bangholm"	52·1	42·3	9·8	2 17 0	12.5—14.0
Soft Turnip "Greystone"	34·7	28·1	6·6	1 8 0	8 — 9
Carrot "Champion" ..	50·8	43·5	7·3	2 1 0	11 —12
,, "White Belgian" ..	52·1	45·7	6·4	1 17 0	11.5—12.5

The difference between the content of solids in roots grown from the best strains and that in roots grown from the worst strains, and the approximate value of this difference as shown in the table, clearly demonstrate for the agriculturist the importance of securing seed from strains of roots that yield high percentages of solids.

As some practical agriculturists held the opinion that mangold solids produced slightly more milk and butter than an equal quantity of swede turnip solids, one of the leading Danish agricultural societies asked the Royal (Danish) Agricultural Laboratory to carry out experiments in order to investigate the relative values of the two kinds of roots as foods for dairy cows.

Seven series of experiments were carried out on three different farms between 1911-1914. Each series included from two to four groups of ten cows each, or 230 cows in all. Besides

* "Barre" was the name of the French seedsman on André Lévêque de Vilmorin's estate in the Department Loiret, from which place the mangold was imported by the Danes and improved by judicious culture. These mangolds are rich in sugar and have an excellent flavour.

† Solids, *i.e.*, the solid matter which remains when all the moisture in a root has been evaporated.

elucidating the relative feeding value of mangolds and swede turnips, the feeding value of roots having a lesser or greater content of solids was also ascertained.

The roots used throughout the experiments were grown from seed supplied by the State Plant Expert and Director of State Nursery Experiments, Mr. L. Helweg.

The manner in which the experiments were carried out was that usually adopted by the Royal Laboratory in their feeding experiments with dairy cows and may be briefly described as follows :—

The cows used for the experiment are tended by an attendant, who has no work on the farm other than that which concerns the experiments. The attendant's work is supervised by an expert from the Royal Laboratory, who visits the farms fortnightly and remains there on every occasion for several days. In addition to the supervision of this expert, the owner of the dairy farm or his steward supervises the work of the attendant daily. Test milkings are carried out bi-monthly. On these occasions the quantity of milk given by each cow, and its content of butterfat, are ascertained. Samples of each cow's milk and of the rations are also sent to the Royal Agricultural Laboratory, Copenhagen.

Each experiment is divided into three parts, viz., the preparatory period; the experimental period; and the post-experimental period.

A uniform group of 10 cows due to calve in autumn is usually selected for the experiment. By a uniform group is implied 10 cows having so very nearly the same milk yield, milk-fat percentage, live-weight, thriving qualities, age, and calving time, as to render it safe to assume that being fed in a uniform manner, they will yield a uniform quantity and quality of milk. Before the cows are finally selected the milk yield of a large number of cows fed in a uniform manner has to be investigated over a protracted period, and the experimental group is finally made up of those cows that show the greatest uniformity during that period.

During the preparatory and post-experimental periods, the rations given to the cows are precisely the same; during the experimental period their rations differ in conformity with the plan and aim of the experiments. Between the preparatory and the experimental periods and between the latter period and the post-experimental period there are short transitory periods during which the rations are gradually changed. All the information obtained is systematically arranged in tables bi-monthly.

In the experiment described in this note seven groups of 10 cows each were fed with mangolds (Barres or Eckendorfer), and seven other groups were fed with swede turnips (Bangholm or Superlative Swedes).

The following table shows the daily rations per cow in both groups *during the experimental period* :—

TABLE I.

	Mangold-fed group. lb.		Swede Turnip fed group. lb.
Corn (oats or barley and oats mixed) ..	0·77	....	0·77
Oilcake	6·12	....	6·12
Roots	79·78	....	83·92
Hay	4·40	....	4·40
Straw	8·59	....	8·59
Analyses of the ration :—			
Root-solids	9·30	....	9·38
Albuminoids	2·91	....	2·99
Fats	0·75	....	0·75
Other organic matter	22·47	....	22·50
*Total nitrogen	0·608	....	0·610

* Of the total n trogen 84–88 per cent. was albumin-nitrogen.

As the above figures indicate, the only appreciable difference in the rations of the groups during the experimental period was that which existed between the weight of the roots, *i.e.*, mangolds, 79¾ lb. approximately, and swede turnips, 84 lb. approximately.

In the following table the average daily milk-yield per cow, together with the average percentages of fat and albuminoids in the milk are set forth :—

TABLE II.

Group.	Average number of lb. of Milk daily per cow during			The Milk contained					
				% of Fats.			% of Albuminoids.		
	Prepar. period.	Exper. period.	Post-exper. period.	Prepar. period.	Exper. period.	Post-exper. period.	Prepar. period.	Exper. period.	Post-exper. period.
				Mangold-fed Groups.					
1	37·43	31·61	26·85	2·85	2·97	3·23	2·87	2·88	—
2	32·27	30·77	28·41	3·13	3·07	3·01	2·83	2·91	2·90
3	36·90	31·61	28·61	2·91	3·02	3·24	2·93	3·04	—
4	35·36	27·66	26·21	3·07	3·06	3·20	2·73	2·87	—
5	33·59	30·64	30·15	2·91	2·93	3·18	2·92	2·97	3·01
6	36·12	31·42	29·74	3·01	3·04	3·23	2·88	3·08	3·31
7	38·92	31·34	27·79	3·45	3·35	3·45	2·89	2·89	3·12
Average..	35·80	30·73	28·26	3·05	3·06	3·22	2·86	2·95	—
				Swede Turnip-fed Groups.					
1	37·42	31·79	26·52	2·76	2·83	3·21	2·98	2·98	—
2	32·27	31·10	28·75	3·15	3·07	3·09	2·86	2·99	2·99
3	36·90	32·01	28·26	2·90	2·95	3·10	2·89	2·95	—
4	33·23	28·85	26·79	3·16	3·07	3·24	2·78	2·84	—
5	33·53	31·08	30·02	2·94	2·87	3·17	2·97	3·01	2·99
6	36·27	31·83	28·52	3·01	3·05	3·27	2·80	3·00	3·43
7	39·00	33·53	28·52	3·44	3·23	3·29	2·89	2·90	3·19
Average..	35·80	31·46	28·21	3·05	3·01	3·20	2·88	2·95	—

It will be observed that the average daily milk-yield of all the groups was :—

	Average for Mangold-fed. lb.		Average for Swede Turnip-fed. lb.
Preparatory period	35·80	....	35·80
Experimental period	30·73	....	31·46
Post-experimental period ..	28·26	....	28·21

During the preparatory period, when all the cows received the same rations, their milk-yield was the same. During the experimental period, when one series of groups received mangolds, and the other series swede turnips, the latter gave a slightly larger quantity of milk than the former. During the post-experimental period, when the rations were again exactly the same, the milk yield average of all the groups was again the same. The average difference in the milk-yield during the experimental period was 0·73 lb. (nearly three-quarters of a pound) per cow daily, or 2·4 per cent. more than the average of the mangold-fed cows. If the milk-yield in Table II. be compared pairwise (*i.e.*, group number one mangold-fed, with group number one swede turnip-fed, and so on down the list), it will be found that the milk yield during the preparatory period was approximately the same, and that during the experimental period, the milk yield of the groups fed with swede turnips was respectively (from No. 1 to No. 7) : 0·18 lb., 0·33 lb., 0·40 lb., 1·19 lb., 0·44 lb., 0·41 lb., 2·19 lb., in excess of that of those fed with mangolds.

The average excess in favour of swede turnips for each of the farms where the experiments were carried out was :—

Rosenfeldt	0·385 lb. of milk daily per cow.
Sanderumgaard	0·396 lb. ,, ,,
Rosvang	1·175 lb. ,, ,,

Whilst the excess on the first two farms was about equal, that on the third farm was three times as great. It must not be inferred, however, that the mangold-fed groups in every instance gave less milk than the turnip-fed ones. In one instance the mangold-fed cows gave slightly more than one-third of a pound of milk per cow daily in excess of the quantity given by those fed on swede turnips.

The average fat percentage of all the groups was :—

	Mangold-fed average. per cent.		Swede Turnip-fed average. per cent.
Preparatory period	3·05	....	3·05
Experimental period	3·06	....	3·01
Post-experimental period	3·22	....	3·20

The figures show that whilst the fat percentages of both groups were equal during the preparatory period, that of the

swede turnip-fed group was 0·05 per cent. lower during the experimental period and 0·02 per cent. lower during the post-experimental period.

It may be noted also that the fat percentages of the turnip-fed groups in Table II. show a greater decrease (or smaller increase) all round than the mangold-fed groups during the experimental period, whilst the opposite is the case during the post-experimental period. It may be inferred, on the whole, that whilst the swede turnips slightly increase the milk flow, they slightly decrease the fat percentage.

As regards the relative value of mangold and turnip solids the results of the experiments show that when the cows received equal quantities of mangold and turnip solids the latter produced a little more milk than the former, but a rather smaller butter-fat percentage.

On the whole, however, the difference was so slight that the Royal Agricultural Laboratory declared one food-unit of solids (1 lb.) extracted from roots of either kind to have—for all practical purposes—the same feeding value.

The Nutrient Values of Roots possessing a lesser or greater content of Solids.—In the experiments carried out to ascertain the feeding values of roots possessing a lesser or greater content of solids, each cow in the several groups received the following average ration daily *during the experimental period* :—

TABLE III.

	Groups receiving roots having a greater percentage of solids. lb.	Groups receiving roots having a lesser percentage of solids. lb.
Corn	0·90	0·90
Oilcake	6·41	6·41
Roots	70·28	85·60
Hay	4·58	4·58
Straw	8·20	8·20
Analyses of the feed :—		
Root-solids	8·507	8·507
Albuminoids	3·075	3·120
Fats	0·738	0·738
Other organic matter	21·820	21·718
Total nitrogen	0·646	0·660

As in Table I., the only apparent difference in the rations lies in the quantity of roots. The cows fed with roots having a lower content of solids received 85½ lb. of roots, while the cows fed with roots having a greater content of solids received only 70¼ lb. The difference in weight amounted to 15¼ lb. of roots daily per cow; the analyses show, however, that the content of solids in either quantity of roots was precisely the same.

In the following table the average daily milk yield per cow together with the average percentages of fat and albuminoids are set forth :—

TABLE IV.

—	Average number of lb. of Milk daily per Cow during			The Milk contained					
				% of Fats.			% of Albuminoids.		
	Prepar. period.	Exper. period.	Post-exper. period.	Prepar. period.	Exper. period.	Post-exper. period.	Prepar. period.	Exper. period.	Post-exper. period.
Groups fed with Roots having a Greater Percentage of Solids.									
Mangolds ..	35·36	27·73	26·83	3·09	3·13	3·25	2·70	2·90	—
" ..	33·55	30·86	30·55	2·94	2·94	3·21	2·92	3·00	3·07
" ..	36·16	31·74	29·86	3·04	3·03	3·18	2·84	3·01	3·25
" ..	38·90	31·78	27·99	3·38	3·30	3·36	2·88	2·89	3·13
Swedes ..	33·51	31·38	29·93	2·92	2·82	3·11	2·91	2·96	2·92
" ..	39·01	33·78	28·48	3·49	3·28	3·36	2·89	2·93	3·24
Average ..	36·09	31·20	28·94	3·14	3·08	3·25	2·86	2·95	(3·12)
Groups fed with Roots having a Lower Percentage of Solids.									
Mangolds ..	35·38	27·62	25·59	3·06	2·99	3·16	2·77	2·85	—
" ..	33·64	30·42	29·77	2·87	2·92	3·15	2·92	2·94	2·95
" ..	36·11	31·12	29·66	2·99	3·05	3·28	2·92	3·16	3·37
" ..	38·92	30·90	27·58	3·51	3·40	3·53	2·90	2·88	3·11
Swedes ..	33·53	30·75	30·13	2·96	2·92	3·22	3·02	3·06	3·06
" ..	38·95	33·26	28·75	3·39	3·17	3·22	2·88	2·86	3·13
Average ..	36·09	30·68	28·57	3·13	3·08	3·26	2·90	2·96	(3·12)

The average daily milk-yield of all the groups was :—

	Groups fed with roots having a high percentage of solids.		Groups fed with roots having a low percentage of solids.
	lb.		lb.
Preparatory period	36·09	....	36·09
Experimental period ..	31·20	....	30·68
Post-experimental period ..	28·94	....	28·57

As the table shows, the average milk-yield per cow was equal during the preparatory period, whilst during the experimental period it was half a pound less per cow daily for those cows fed with roots having a low percentage of solids. As may be observed in Table IV., this milk shortage was general in all the experiments. It may be deduced from this, that the nutrient value of 1 lb. of solids in roots of high solid percentage is greater than that in roots of low solid percentage.

As the milk-yield did not again increase in quantity during the post-experimental period when the cows again received precisely the same rations, but continued to diminish slightly, it is difficult to say what importance should be attached to the shortage of half a pound daily per cow during the experimental period.

As any conclusions that may be drawn with regard to any difference between turnips and mangolds in this connection

must of necessity be exclusively based on the rather uncertain figures of the post-experimental period, it is not justifiable to do more than draw attention to the figures.

With regard to the effect of roots of high and low solid percentages on the live-weight of the cows it will be seen from the following table that no difference was to be observed in favour of either :—

TABLE V.

—	Average Live-weight per Cow in lb. during		
	Preparatory period.	Experimental period.	Post-experimental period.
Groups fed with Roots having a High Percentage of Solids.			
Group No. 4	1,018	996	981
,, 5	992	996	—
,, 6	998	1,014	1,042
,, 7	1,029	1,007	990
,, 8	976	965	—
,, 9	1,038	1,003	983
Average	1,009	996	(998)
Groups fed with Roots having a Low Percentage of Solids.			
Group No. 4	1,027	1,005	985
,, 5	998	1,005	—
,, 6	965	990	1,016
,, 7	1,036	1,009	976
,, 8	967	967	—
,, 9	1,031	996	976
Average	1,005	996	(990)

The average daily increase (+) or decrease (—) in the live-weight of the animals was as follows :—

	Groups fed with roots having a high percentage of solids. lb.		Groups fed with roots having a low percentage of solids. lb.
Preparatory period	— 0·419	....	— 0·419
Experimental period ..	+ 0·110	....	+ 0·198
Post-experimental period ..	— 0·309	....	— 0·397

The result of the comparison between roots of different solid percentages, as disclosed by the experiments, was that there is little or no difference in their nutrient value when used in conformity with their content of solids.

The Value of the Turnip as a Vegetable and Stock Food.

THE Board have received the following note on the value of the turnip as a vegetable and stock food from Mr. S. H. Collins, M.Sc., Armstrong College, Newcastle-on-Tyne :—

Composition.—Of the different sorts of turnips the swede has the highest feeding value. The average analysis of a very large number of swedes grown at Cockle Park is as follows :—Water, *88·00 per cent.*; *amides, 0·47 per cent.*; *albuminoids*, 0·59 per cent.; sugar, 6·48 per cent.; mucilage, gum, &c., 2·84 per cent.; fibre, 1·00 per cent.; and ash, 0·62 per cent. The composition varies with variety, soil, and season, the last being the most important; thus of the swedes examined at Armstrong College during the last 16 years the annual *average* content of dry matter has varied between 10·32 per cent. and 14·96 per cent.

Yellow and soft white turnips are inferior to swedes in feeding value, having been found at Cockle Park to contain, on the average, 9 per cent. and 8 per cent. respectively of total dry matter.

In the majority of cases more than one-half the dry matter of swedes is sugar—mostly of the grape sugar type; during the last 16 years at Armstrong College the sugar in swedes has been found to vary between 43 per cent. and 72 per cent. of the dry matter, with an average of 54 per cent. (or 6½ per cent. of the whole swede). Even neglecting the other nutrients and taking the sugar content at 6¼ per cent. this would mean that 16 lb. of swedes would have the food value of 1 lb. of sugar, so that, apart from the difficulty of substituting swedes in cases where sugar is used, an ordinary swede turnip weighing a little over 3 lb. would at present be worth about 1*d*. for its food value.

Use as a Vegetable.—The content of sugar in swedes rises during storage from about 50 per cent. of the dry matter when first pulled to 60 per cent. in the spring, and hence the late winter and spring months appear to be the best period in which to use swedes as a vegetable.

It is a mistake to use the white turnip as a vegetable in preference to the swede, since, as shown above, the latter has a higher food value; it is also a mistake to use freshly pulled roots. Further, turnips of all kinds should not be boiled and served mashed, as this treatment removes, in the water, much of the sugar and other nutrients; they are more fully utilised when served in soups, stews, or curries, or they

may be cooked by steaming. Much larger quantities of swedes could, with advantage, be used as human food.

Use as a Stock Food.—On the basis of sugar content 10 tons of swedes would be worth rather more than 1 ton of feeding treacle containing 60 per cent. of total sugar at £10 per ton (see p. 77), *i.e.*, from this point of view the swedes would be worth over £1 per ton. Further, the constituents other than sugar are worth 10*s.* per ton in comparison with the prices of purchased foods (see p. 79). Valuing the whole of the nutrients on the food unit basis, however, the 11 food units present would cost the farmer 22*s.* to replace if he had to purchase feeding stuffs. Even if the farmer sold his swedes off the farm there would be a wide margin between the 22*s.*-30*s.* per ton estimated value as a stock food, and the £3 per ton (retail) estimated value as human food.

Medicinal Plants in England.

A REVISED edition of the Board's Leaflet No. 288 (*The Cultivation and Collection of Medicinal Plants in England*) has just been issued, and the following extracts are reprinted therefrom :—

Medicinal herbs have been cultivated in this country for centuries, and in the middle ages were grown in kitchen gardens attached to monastic establishments and great country houses. At the present day materia medica (or drug) farms exist at Mitcham, Carshalton, Hitchin, Long Melford, Market Deeping, and Wisbech, but for many years the main source of British drugs has been Mid-Europe, particularly Germany and Austria-Hungary.

During recent years the acreage devoted to drug cultivation in Britain has been more and more restricted by competition with foreign products, and the result has been a slow but sure ousting of British-grown drugs from the market. The outbreak of a European war has completely changed the situation, and an effort on the part of growers and drug merchants may largely secure for this country in future years the collection and cultivation of medicinal plants which cannot for the present be imported from Central Europe.

Supplies of drugs are much in demand, the shortage being serious, and the prices* of most of the crude drugs that were formerly imported from enemy territory have risen very considerably—in the case of Belladonna, for instance, by

* An endeavour has been made to give in the leaflet average prices up to the time of going to press, but in view of the considerable fluctuation in prices the Board feel that they can only be taken as a general guide for the immediate future.

about 600 per cent.; the prices of other medicinal herbs (Colchicum, Digitalis, Henbane, Stramonium, Valerian, Dill, Dandelion, etc.), have risen in proportion to the importance and scarcity of the herbs. The present time, therefore, is particularly favourable for the establishment of a home industry in the cultivation of medicinal plants—not only for home use but possibly for export, for it is not anticipated that prices will revert to their old level until long after the war is over. Prices are now sufficiently good to meet with ease the present high cost of labour, and it is felt that judicious cultivation of drug plants should result in quite adequate profits. *In connection with labour it is possible that disabled* soldiers and sailors could do a great deal of the work required.

In the past year experiments were made in growing Belladonna, Henbane and Blessed Thistle, and the following results have been communicated to the Board :—

Belladonna.—The yield per acre in the first year of growth amounted to about 6 cwt. of dry leaves, which were sold for 2*s.* per lb., or £67 4*s.* per acre. The price of leaves before the outbreak of war was 60*s.*, or under, per cwt.

Henbane.—The yield amounted to about 15 cwt. of dry herb per acre, the price obtained being about 1*s.* 3*d.* per lb.—*i.e.*, 140*s.* per cwt., or £105 per acre.

Blessed Thistle.—In the case of this plant the yield amounted to about 35 cwt. of dry herb per acre, the sale price being £29 per ton, or £50 15*s.* per acre. The price before the outbreak of war was £27 per ton.

General Considerations.—While the price of the more important drug plants has risen seriously, and British-grown crops are likely to realise high prices, it needs to be fully recognised that the limited outlet for many drugs makes overloading the market a comparatively easy matter, and any grower who proposes to devote attention to the cultivation of medicinal plants should give the matter careful consideration before embarking on it to any serious extent For growers, however, who can successfully raise good crops, excellent returns should be secured in the near future.

The prospective grower or collector should give close attention to several points which are of importance and may present difficulties: (1) How to Secure Seed; (2) What to Grow or Collect, and Where to Sell; (3) How to Dry and Market the Crop.

(1) *How to Secure Seed.*—It will probably be possible to obtain seeds of the various medicinal plants through the

larger firms of seed merchants, or through drug merchants and distilling firms interested in buying crops. A list of addresses may be obtained on application to the Board.

(2) *What to Grow or Collect, and Where to Sell.*—In the ordinary way a few pounds of dried herb are only disposed of with difficulty, buyers requiring hundred-weights or none. At present, however, drug plants will be saleable in much smaller quantities than usual. When considering what to grow or collect it is desirable to consult the prospective buyer of the crop, who will usually be prepared to give expert advice on this point, and who, of course, knows what is likely to be required at any given time. While it is possible to overload the market with a given drug it may be observed that the quantities of crude drugs used are very large. For example, the annual crop of Belladonna in Croatia and Slavonia has been estimated at 60 to 100 tons of dry leaves and 150 to 200 tons of dry root.

If possible, the grower should consult wholesale druggists, and preferably make an arrangement with one of these to purchase the crops grown. A useful plan might be to contract for one half the crop to be taken at a pre-arranged price and the remainder at market prices at the time of harvesting the crop.

It may be said that the plants which are likely to be most in demand, and will be easily saleable during the coming season, are Belladonna, Henbane, Foxglove, Thorn Apple, Valerian, Poppy, Aconite, Blessed Thistle, Dandelion, Chamomile. Many of the other species named below will also find a fairly ready market if well grown or collected, and well marketed.

(3) *How to Dry and Market the Crop.*—The careful picking or harvesting and drying of medicinal herbs is a matter of great importance, and regular growers have proper drying plant, heated artificially, so that quantities of the drugs can be dried quickly and thoroughly in a current of warm air. Facilities for drying purposes are desirable for growers of medicinal herbs. Glasshouses could readily be converted into drying sheds, especially if heated by pipes. Drying could be done in half shade in fine summer weather by spreading thin layers of the leaves on wooden racks or sheets of paper or cardboard in the open, or on racks or shelves in a freely-ventilated shed, turning frequently until quite dry. The leaves or flowers must be kept under cover at night or during rain. "Even colour" is best retained by quick drying, and the brighter the colour the more saleable is the product.

Growers or collectors who intend to market dry leaves or flowers could gather and dry in small quantities, which are more manageable. Roots present less difficulty in washing and drying.

In London several establishments make it their business to dry medicinal herbs and roots, and if fresh plants are forwarded by passenger train lightly packed in wooden boxes, in the same manner as flowers are marketed, they would probably usually arrive in good condition, and be carted direct by the buyer to the drying house.

In the forests of Hungary the means of drying are very primitive, consisting simply of a wooden shed divided into compartments of trays made of wire netting tacked on wooden frames. The heat for drying is generated by coke fires, and the ventilation is obtained by making small holes in the walls near the roof.

Growers may find it useful to dry their crop when possible, as they will then be less dependent on an immediate market for sale, and be able to arrange better terms of sale, unless they grow by contract, when drying may be a mere matter of convenience as between grower and buyer.

Co-operation.—The most important drug industry—cinchona bark production—has during recent years shown the effectiveness of co-operation between producer and manufacturer in restricting the output within reasonable limits. So far, consumers appear to be unaffected, while all other handlers of bark and quinine, other than speculators, are in a decidedly better position.

Some arrangement might perhaps be made to ensure British drug growers a fair return for their efforts. Co-operation between growers in any given district, and between growers and wholesale druggists would probably prove effective.

Soil and Manuring.—Soil in good condition for ordinary farm crops is suitable for growing most medicinal plants. In general, care should be taken to keep down weeds and ensure a good tilth. A good dressing of farmyard manure is usually advantageous, although not actually necessary.

The southern and midland counties of England are especially suited to drug growing, and are further favoured in being close to the principal consuming market.

NOTE.—There follow in the Leaflet nearly twelve pages giving notes on the cultivation and collection of various medicinal plants.

Scheme* for the Increase of Poultry Production.
(Preliminary Notice.)

(i.) *Egg-Distributing Scheme.*—The sanction of the Treasury for the expenditure on the scheme for the establishment of stations for the distribution of sittings of eggs of pure-bred fowls in England and Wales, and for the establishment of Incubating Stations in North Wales was received about the middle of October, 1915, and on the 21st October a circular letter was issued by the Board to the Local Authorities of the 47 counties which had been selected, for the purpose of the Scheme, inviting their co-operation in the work.

As it was very desirable that the great majority of stations should be established by the middle of January, 1916, it was necessary to discover as soon as possible the number of Local Authorities who were prepared to authorise the establishment of egg-distributing centres. With the object of securing this information arrangements were made to visit the Chairman of the County Committee and the Agricultural Organiser in the great majority of selected counties, and in many cases meetings of the Agricultural Committee were attended. On the whole the Scheme met with comparatively little opposition, although it was freely criticised. The criticism followed a fairly well-defined line of attack: it was argued that the remuneration offered to the Station Holder was too small, that the small holder and cottager would not show any anxiety to get a better class of egg for hatching, and that if they were anxious to do so their enthusiasm would not carry them so far as to invest in a postal order for 2s. and to write letters. Those in the immediate neighbourhood might apply for the eggs, but the Station Holder would find difficulty in making up the sixty dozen eggs which would qualify him to obtain the full premium of £5. There were also detailed criticisms of the conditions, but criticism was almost always helpful and was infinitely preferable to an uninterested acceptance or refusal.

In the case of four selected counties the Local Authority stated that they could not see their way to adopt the Scheme, and in a fifth county the difficulties of providing for inspection made it impossible to establish stations. On the other hand, many counties to which three stations were originally allocated have asked for and have established additional stations, and so far no complaints have been received concerning lack of orders for eggs. Many Station Holders voluntarily exceeded

* A copy of the Scheme was published in the *Journal* for November, 1915, p. 812.

the limit of 60 sittings which entitled them to earn the full grant of £5. To take an example almost at random, at one station in the Bristol area 104 sittings of eggs have been booked, which means that the Station Holder has voluntarily sold an extra 44 sittings at 2*s*. In this case the stock is of good quality and the management is most painstaking. In the Cambridge area another station had up to the 8th March booked 185 sittings.

The great difficulty met with in many counties was the late date at which the stations were selected. The explanation is not difficult of solution: while exceptional prices obtained for fresh eggs the prospective Station Holder was inclined to "shy" at the conditions, but early in January, when the price of eggs fell, applications came in freely, and the reiterated criticism concerning insufficient inducement to the Station Holder died down. It would be unfair to imply that this attitude was assumed by all or even by a majority of prospective Station Holders, but it certainly characterised a section of them.

On the whole, the type of Station Holder secured by the Local Authorities is good, and it is no exaggeration to add that eggs of the quality issued from many of the stations have not previously been accessible to the average cottager and small holder.

The number of stations for which provision was made in the Scheme was 144, and the number of stations actually in operation is 136; it has been necessary to refuse certain applications owing to the late date on which they were received. The 136 stations are distributed in the various Provincial areas as follows (number of stations in brackets):— No. 1, Armstrong College (9); No. 2, Yorkshire College, Leeds (7); No. 3, Midland Agricultural and Dairy College (12); No. 4, Cambridge University (14); No. 5, Wye College (15); No. 6, University College, Reading (12); No. 7, Seale Hayne College (8); No. 8, Bristol University (15); No. 9, Harper Adams College (7); No. 10, University College of Wales, Aberystwyth (19); and No. 11, University College of North Wales, Bangor (18).

(ii.) *The Establishment of Incubating Centres in Bangor Provincial Area.*—The suggestion that two Incubating Stations should be established in the North Wales area was favourably received by the Agricultural Department of the University College for North Wales, and also by the Local Authorities concerned. Indeed, the Local Authority for Anglesey made

strong representations for the establishment of a third station in Anglesey, and expressed their willingness to give every possible assistance if the Board would consent to this arrangement. After consultation with the Authorities for Carnarvon and Anglesey it was decided to establish three stations in North Wales—one at Lleweni Hall Dairy School to serve Flint and Denbigh, one at Madryn to serve Carnarvon, and one in Anglesey to serve that island.

The original grant was divided for this purpose as follows: One-half of the grant to be allocated for the equipment of the Lleweni Station; one-quarter of the grant for the equipment of the Madryn Station; and one-quarter of the grant for the equipment of a station in Anglesey.

The place eventually selected for the Anglesey Station was the old college farm at Lledwigan, near Llangefni, where exceptional facilities existed for housing poultry in suitable unoccupied farm buildings. A reasonable area of grass was also available.

The fact that the Board's equipment, which had been in use at Morden Hall up to October, 1915, was no longer required, made it possible for a number of good poultry houses, a quantity of wire netting and posts, and some miscellaneous appliances, to be transferred on loan to the three Welsh stations. The stock and additional equipment required have been provided by means of the grant.

Miss M. Black, a former student of Kilmarnock, was appointed to take charge of the station at Lleweni Hall; Miss M. Stanton, who worked both at Haslington Hall and Morden Hall, was appointed for Lledwigan; and Mr. Rowlands, with Miss C. Crosse (who was trained under Miss Edwardes at Coaley) as assistant, is in charge of the Madryn Station.

There was some difficulty in obtaining suitable stock for these Stations so late in the season, but on the whole the stock is very satisfactory, and has been obtained from representative utility breeders in England. The breeds represented at the three stations are White Wyandotte, White Leghorn, Rhode Island Red (Single Comb), Faverolles, and Barred Plymouth Rock.

The three stations are now in full working order and the distribution of day-old chickens has commenced.

The Local Authorities concerned have taken considerable trouble and have not spared expenditure in their endeavour to make the stations a success, but it is not yet possible to estimate the value of this special scheme.

Management of Allotments for Tenants on Military Service.

THE question of the management of allotments and of the many *smaller unequipped* holdings in the absence of tenants on military service is necessarily receiving the attention of the Local Authorities. The proportion of such allotments and holdings held by single men in rural areas is not very large, but when the married men are called up, it will be found, more particularly in fruit-growing and market-gardening districts, that the matter will require prompt and sympathetic handling if a deterioration in the standard of cultivation and loss of production are to be avoided.

The Moulton (Lincolnshire) Parish Council have recently considered the question. The Council hold on lease 50 acres let under the grazing right system, and 933 acres let to 157 tenants in allotments and small holdings. An enquiry has shown that of the tenants 17 are single men, 59 are married men under 41, 76 are married men over 41 years of age, and five of the allotments are held by widows. Of the single men, six have been in the Army for some time, and 12 altogether have been passed for service. Several of the married men have attested; and it is reasonable to suppose that an appreciable number will in due course leave the neighbourhood for training, though it is impossible at present to say approximately how much land will eventually be affected.

Several of the tenants, single men, have already arranged with relatives or friends for the cultivation of their allotments in their absence; and in any case where the tenant himself is unable to make such arrangements, the Parish Council have decided to take the management into their own hands.

In order to give effect to this decision, three committees for the three Wards of the parish (11,800 acres in extent) will become management committees for this purpose, will hire team and manual labour, and purchase seed corn, potatoes, &c. Any profit made on any allotment will be given to the tenant on his return, or to his representatives. The Council have a substantial credit balance on the working of their allotment schemes; in case of loss, which could not be recovered by the Council, the ratepayers would be fully protected. The Council have a Finance Committee to which accounts will be submitted.

In this parish there has been a good deal of co-operation among the small farmers and small holders in working their

holdings, and in the use of implements. It is probable that most of the tenants who enter the Services will be able to make their own arrangements for the temporary cultivation of their land. At the same time, by superintending these arrangements and putting themselves in a position to farm the land themselves if necessary, the Council have taken a step which may be commended to the consideration of other Councils.

Successful Employment of Women on the Land.

A number of instances have already been described in this *Journal*,* in which the replacement of male by female labour on farms has been attended with success, and the additional cases cited below serve further to show in how large a measure the present shortage of labour might be met if farmers would realise the willingness and aptitude of many women for work on the land.

(1) As an example of a satisfactory method of dividing work between men and women, the system followed on a dairy farm in the Devizes district may be mentioned. The dairy herd comprises 65 cows in milk and some 30 dry cows, in addition to which dry cows are brought up to this farm, which is on the down, from another farm in the same occupation. The milking cows run on the down in winter and summer alike, by day and night. They are only brought into the sheds for milking, and are fed indoors on long oat straw and cake, and outdoors on swedes.

The milking is done by contract, the 65 cows being divided between the dairyman, his son, and four daughters, all young girls. The contract rate for milking and tending the cows in milk is 1s. per cow per week. For extra work in connection with dry cows and young cattle the dairyman is paid separately.

The family have been so employed for 10 years. The girls learnt to milk very young; the youngest used to milk while still attending school at 10 years of age. The work is divided as follows: The men cart the straw and cake to the sheds, the girls helping with the distribution along the mangers, while the men deal with the roots. The father reserves for himself and his son those cows which are "hard" milkers or are unruly, while the girls milk their proper share of the rest of the herd. What little cleaning out is necessary is done by

* December, 1915, p. 865, and January, 1916, p. 1006

the men. The girls pour the milk from their pails into the churns, all subsequent handling being done by the men, the latter also attending to the calvings and looking after the bull.

The girls thus do about 3 hours' milking daily, being at other times occupied with poultry and house work. Their interests are well safeguarded and they are not expected to do anything detrimental to their physical welfare. In this instance, the criticism usually made against contracts of this description, *i.e.*, that parents are inclined to exploit their children's labour at too early an age, does not seem to have any force.

(2) Three girls, 17, 17½, and 19 years of age do everything for 26 cows—milking, feeding, scouring milking utensils, and the "mucking out." They are in the cow-house at 5 a.m.—never late—and milk again at 3 p.m. They live in the farm house, breakfast at 8 a.m., lunch at 12 p.m., dine at 6 p.m., and go to bed at 8.30 p.m. The milking is done by hand, and the girls also harrow, plough on light land, and use the horse-hoe. They are said to be "exceptional girls, none better anywhere." All are educated and one has musical honours.

(3) On a Cheshire home farm a woman has been employed since April, 1915, to look after the cows. She does everything connected with the cows, and no man goes near them. The employer states that the cows have never been in such good condition as now, and have never given so much milk. The woman is paid 20s. per week, with free lodging and coal.

(4) One report says: "There is a farm in Devon where all the men have gone and five women are doing the whole work. I have placed women as carters in three counties and they are doing well."

These instances are sufficient to show that women are capable of performing satisfactorily many forms of agricultural work, and that farmers will be well advised to enlist their help to replace the male labour they have lost. The canvass of the women is showing that they are ready to offer their services, but the farmers must realise that in view of the large demand for women's labour in other industries, they cannot expect women to work on the land unless they are prepared to pay good wages.

Notes on Feeding Stuffs in April: *From the Animal Nutrition Institute, Cambridge University.*

Prices.—It is pleasant to note for the first time a general fall in the price of feeding stuffs, varying from ½*d.* to as much as 3*d.* per food unit. The fall is most pronounced in the case of Bombay cotton cake, English linseed cake, and maize. Cotton cake and maize are, however, still too dear to be recommended for general use, but linseed cake at present prices is quite reasonable as compared with other foods. The various tables are set out on the same plan as last

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of March.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soya Bean Cake	122·3	10	17	6	11	0	0	10	17	6	11	10	0
Decorticated Cotton Cake	126·3	12	15	0	13	2	6		—			—	
Indian Linseed Cake ..	123·1	12	1	3	12	10	0		—			—	
English Linseed Cake ..	120·1	12	5	0	12	10	0	11	5	0	11	12	6
Bombay Cotton Cake ..	65·3	9	5	0	9	12	6	9	5	0	9	7	6
Egyptian Cotton Cake ..	71·9	9	10	0	9	15	0	9	15	0	9	17	6
Coconut Cake	102·6	10	2	6	10	15	0		—			—	
Palm-nut Kernel Cake ..	90·5	9	5	0	8	5	0		—		9	2	6
Ground-nut Cake	145·2	†11	12	6		—		10	15	0	11	12	6
English Beans	99·5	10	15	10	13	6	0	12	4	3	12	4	3
Chinese Beans	101·2	11	18	0	12	2	8		—			—	
English Maple Peas ..	97·2	13	2	3		—		14	4	5		—	
English Dun Peas ..	97·2	12	0	0		—		14	0	0		—	
Calcutta White Peas ..	97·5	18	8	11		—			—			—	
American Maize	93·8	11	13	4	11	16	2		—			—	
Argentine Maize	94·2	11	4	0	11	15	2	11	4	0	11	13	4
Maize Meal	86·5	12	0	0	12	10	0	12	15	0	12	0	0
Maize Gluten Feed ..	121·6	11	10	0		—			—		12	0	0
Maize Germ Meal ..	99·2	11	15	0	12	15	0		—		12	5	0
English Feeding Barley ..	83·0	14	0	0		—		14	0	0	12	17	7
English Oats	75·4	11	13	4	12	0	7	11	0	0	11	16	8
Argentine Oats	75·4	11	1	1		—			—		11	15	9
Malt Culms	69·9	7	15	0	9	0	0	7	0	0	8	0	0
Brewers' Grains (dried) ..	84·5	9	0	0		—		8	15	0	9	5	0
" " (wet) ..	21·1	1	7	0		—		1	5	0		—	
Egyptian Rice Meal ..	78·7	13	0	0		—		10	0	0		—	
Burmese Rice Meal ..	78·7	12	0	0	9	0	0		—		11	0	0
Wheat Middlings (coarse)	93·4	* 9	5	0		—		9	17	6	11	5	0
Wheat Sharps	86·3	9	10	0	9	10	0	10	0	0	10	5	0
Wheat Pollards	81·9		—		8	12	6		—			—	
Wheat Bran	77·5	8	7	6	8	10	0	9	0	0	8	15	0
Wheat Bran (broad) ..	79·9	9	0	0	9	0	0	10	0	0	9	5	0
Feeding Treacle	60·0	9	15	0	12	10	0		—			—	
Linseed	153·5	20	17	4	§26	0	0	19	2	4	20	17	4
" Oil	250·0	42	10	0	‡48	0	0	42	0	0	49	15	¶7
Egyptian Cotton Seed ..	108·6	14	2	6		—		14	0	0		—	
Brazilian " " ..	107·6		—			—			—			—	
Cotton Seed Oil	250·0		—		‡55	0	0		—			—	

* Fine (London) £12. ‡ In barrels.
† 2nd grade (London) [illegible] § Cleaned.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	3½	Argentine maize ..	2	4½
Ground-nut cake ..	1	7¼	English dun peas ..	2	5½
Soya bean cake	1	9¼	American maize.. ..	2	5¾
Maize gluten feed ..	1	10¾	Egyptian cotton seed ..	2	7¼
Indian linseed cake ..	1	11½	Egyptian cotton cake ..	2	7¾
Coconut cake	1	11½	English maple peas ..	2	8½
Wheat middlings ..	1	11¾	Linseed	2	8¾
Decorticated cotton cake	2	0¼	Maize meal	2	9½
Palm-nut kernel cake ..	2	0½	Bombay cotton cake ..	2	10
English linseed cake ..	2	0½	Argentine oats	2	11¼
Brewers' grains (dried) ..	2	1¾	Burmese rice meal ..	3	0½
Wheat bran	2	2	English oats	3	1¼
English beans	2	2	Feeding treacle	3	3
Wheat sharps	2	2½	Egyptian rice meal ..	3	3¾
Malt culms	2	2½	English feeding barley..	3	4½
Wheat bran (broad) ..	2	3¼	Linseed oil	3	5
Chinese beans	2	4¼	Calcutta white peas ..	3	9½
Maize germ meal ..	2	4½			

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Soya bean cake	1	9½	American maize.. ..	2	6¼
Palm-nut kernel cake ..	1	9¾	Maize germ meal ..	2	6¾
Indian linseed cake ..	2	0½	Malt culms	2	6¾
Decorticated cotton cake	2	1	English beans	2	8
English linseed cake ..	2	1	Egyptian cotton cake ..	2	8½
Coconut cake	2	1¼	Maize meal	2	10½
Wheat pollards	2	1¼	Bombay cotton cake ..	2	11¼
Wheat bran	2	2½	English oats	3	2½
Wheat sharps	2	2½	Linseed	3	4¾
Wheat bran (broad) ..	2	3¼	Linseed oil	3	10
Burmese rice meal ..	2	3½	Feeding treacle	4	2
Chinese beans	2	4¾	Cotton seed oil	4	4¾
Argentine maize	2	6			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	2¼	Linseed	2	6
Ground-nut cake ..	1	5¾	Egyptian rice meal ..	2	6½
Soya bean cake	1	9¼	Egyptian cotton seed ..	2	7
English linseed cake ..	1	10½	Egyptian cotton cake ..	2	8½
Malt culms	2	0	Bombay cotton cake ..	2	10
Brewers' grains (dried) ..	2	0¾	English dun peas ..	2	10½
Wheat middlings ..	2	1½	English oats	2	11
Wheat sharps	2	3¾	English maple peas ..	2	11
Wheat bran	2	4	Maize meal	2	11½
Argentine maize	2	4½	Linseed oil	3	4¼
English beans	2	5½	English feeding barley ..	3	4½
Wheat bran (broad) ..	2	6			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground-nut cake ..	1	7¼	English beans	2	5½
Soya bean cake	1	10½	Argentine maize ..	2	5¾
English linseed cake ..	1	11¼	Linseed	2	8¾
Maize gluten feed ..	1	11¾	Egyptian cotton cake ..	2	9
Palm-nut kernel cake ..	2	0¼	Maize meal	2	9½
Brewers' grains (dried) ..	2	2¼	Burmese rice meal ..	2	9¾
Wheat bran	2	3	Bombay cotton cake ..	2	10½
Malt culms	2	3½	English feeding barley ..	3	1¼
Wheat bran (broad) ..	2	3¾	Argentine oats	3	1½
Wheat sharps	2	4½	English oats	3	1¾
Wheat middlings ..	2	4¾	Linseed oil	3	11¾
Maize germ meal ..	2	5½			

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	3	Maize germ meal ..	2	5½
Ground-nut cake ..	1	6¾	American maize.. ..	2	6
Soya bean cake	1	9¾	Egyptian cotton seed ..	2	7
Maize gluten feed ..	1	11¼	English dun peas ..	2	8
Palm-nut kernel cake ..	1	11½	Egyptian cotton cake ..	2	8½
English linseed cake ..	1	11¾	Burmese rice meal ..	2	8½
Indian linseed cake ..	2	0	English maple peas ..	2	9¾
Coconut cake	2	0½	Linseed	2	10
Decorticated cotton cake	2	0½	Maize meal	2	10¼
Wheat pollards	2	1¼	Bombay cotton cake ..	2	10½
Brewers' grains (dried) ..	2	1½	Egyptian rice meal ..	2	11
Wheat middlings ..	2	2	Argentine oats	3	0½
Wheat bran	2	2¾	English oats	3	1
Wheat sharps	2	3¼	English feeding barley ..	3	3½
Malt culms	2	3¼	Linseed oil	3	7¾
Wheat bran (broad) ..	2	4	Feeding treacle	3	8½
Chinese beans	2	4½	Calcutta white peas ..	3	9½
English beans	2	5¼	Cotton seed oil	4	4¾
Argentine maize ..	2	5¼			

month. Some suggestions for changes in rations are given, but, on the whole, the rations of last month may be continued.

Suggested Rations for April.—*For Horses.*—There does not appear to be any reason for altering the ration suggested last month as regards concentrated food. At this time of year, however, chaff is likely to be very dry and unappetising, and its palatability and feeding value will be much improved by moistening it before use with water in which linseed or linseed cake has been soaked. If linseed is used, it should be boiled to a jelly in water at the rate of about 2 lb. linseed per horse per week. Linseed cake is rather easier to use, because it swells up well in cold water; it should be employed at the rate of about 3 lb. per horse per week.

For Milch Cows.—Last month's rations will probably still be satisfactory, but for cows beginning to go out to grass, it will be a good plan to replace half the concentrated ration by bean meal up to not more than 2 lb. per head per day. This will prove a cheaper way of preventing scouring than by using cotton cake at present prices. Where the roots, etc., are finished before the grass is ready, the succulent part of the ration may be replaced as a temporary measure by a mash of bran, pollards, or other similar wheat offal, with a little chaff. The following mixture may be used to replace 56 lb. of roots :—2 lb. bran, 2 lb. pollards, sharps, or middlings, and about 2 lb. of chaff. It should be made into a rather wet mash, and 1 lb. or 2 lb. of the concentrated ration should be replaced by an equal weight of bean meal.

Rations for other stock as last month.

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible.				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground-nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake ..	1 : 4·6	12·5	7·7	39·0	69·5	90
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 5·3	12·0	3·0	56·0	59·1	78
Wheat sharps	1 : 5·0	12·0	4·0	50·0	58·4	77
Wheat pollards	1 : 5·3	11·6	3·5	53·0	54·1	71
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·[illegible]	11·2	3·0	45·4	48·1	63

Notes on Manures in April:
From the Rothamsted Experimental Station.

OWING to the lateness of the season many farmers are behind with their sowing of spring corn: reference may be made to the notes given last month for an account of suitable dressings.

Top dressings can still be applied to the winter corn, and it is probably not yet too late to use sulphate of ammonia for the purpose, but the more quickly-acting nitrate of soda will probably be safer in most cases.

Farmers should now arrange their dressings for potatoes, mangolds, turnips, etc. The manuring may be on the following lines:—

Potatoes.—Heavy dressings of London dung have in the past been used by many growers in the Home Counties, but these dressings are not really necessary, and can be replaced by appropriate dressings of artificials. Indeed, experiments in many centres have shown that a small dressing of dung—10 tons per acre—supplemented by artificials usually gives larger crops of better quality than large dressings of dung without artificials.

A suitable dressing is 10 to 15 tons of dung applied at the time of planting in the north, but in winter, if possible, in the south and west, and supplemented by the following: 1 cwt. of sulphate of ammonia, 4 cwt. of superphosphate, and 1 cwt. of sulphate of potash; or, 1½ cwt. of sulphate of ammonia, 4 cwt. of superphosphate, and 1½ cwt. of sulphate of potash.

In the Glasgow experiments* a mixture of basic slag and superphosphate (1½ cwt. of each) was better than superphosphate alone; at Holmes Chapel† steamed bone flour (3 cwt.) was better than either; and in the Northumberland and Durham districts 2 cwt. of high grade basic slag is recommended in place of the superphosphate.

Where dung was applied, the omission of potash did not prove serious in cool, moist districts, *e.g.*, in Lancashire,‡ Wales,§ and Somerset,‖ or on land in good condition in Herts.¶ In these circumstances, therefore, the grower need not be over anxious if he cannot get potash, so long as he has dung; he can use 1 to 2 cwt. of sulphate of ammonia, and 4 cwt. of superphosphate or 2 cwt. of bone meal in addition to the dung.

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* West of Scotland Agric. Coll., Bull. 51, 1909.
† Holmes Chapel Year Book, 1909.
‡ Lancs C.C. Farmers' Bulletin 13.
§ Aberystwyth Rept., 1906.
‖ Somerset C.C. Rept. on Field Trials, 1900-1908.
¶ Herts C.C. Leaflets 6 and 7.

In the more forward districts on lighter soils, however, *e.g.*, Herefordshire,* Devon,† Bedford,‡ and Wiltshire,§ potash proved more necessary, and greater efforts must be made to secure it. Some of the salt cake now obtainable contains a certain amount of potash, but it should only be applied to potatoes after analysis has demonstrated that there is sufficient potash to make the material worth using, and that no free acid is present.

On peaty soils the dressing of sulphate of ammonia can be reduced, and in the fens it can be dispensed with altogether.

On clay fen land the following has worked well: || No dung, with up to 8 cwt. of superphosphate; and on clay silt lands: No dung, but 4 to 6 cwt. of superphosphate, and ½ cwt. of sulphate of potash.

On the whole, sulphate of ammonia and superphosphate have proved better than nitrate of soda and basic slag, both of which rather tend to set up alkaline conditions favourable to scab. Lime is to be avoided for the same reason.

No grower should omit to spray the main crop varieties.

Mangolds.—The mangold is a very popular crop because it responds to liberal manuring; indeed, it gives more produce per acre than any other crop.

Experiments have shown that mangolds need nitrogen in addition to dung. Suitable dressings are: (1) Up to 20 loads of dung; (2) 1 cwt. of sulphate of ammonia, 2 to 4 cwt. of superphosphate or basic slag,|| and 2 to 4 cwt. of salt in the drills; or (3) 1½ cwt. of nitrate of soda as a top dressing when the plants are hoed and singled.

On peaty soils or heavy clay soils in cool, wet districts, the sulphate of ammonia can be omitted and the phosphate increased. Slag is then better than superphosphate.

On black fen soils, however, 6 cwt. of superphosphate alone, without dung or other fertiliser, proves sufficient.

Swedes and Turnips.—The treatment of swedes and turnips has to depend very much on the yield that can be expected, and this is partly a matter of soil, but largely one of climate.

If the climate allows more than 20 tons per acre to be grown liberal manuring may be adopted. A good dressing of dung can be given, supplemented by artificials rich in phosphates.

* Hereford C.C., Bull. No. 2.
† Devon C.C., Rept., 1907-1909.
‡ Beds C.C., Rept. on the Demonstration Plots, 1907.
§ Wilts C.C., Results of Field Demonstrations, 1908-9.
|| In the Northumberland experiments basic slag was better than superphosphate.

A suitable dressing is: 10 to 15 tons of farmyard manure, 4 to 6 cwt. of superphosphate or basic slag,* and 1 cwt. of sulphate of ammonia in the drills.

On peaty soils the sulphate of ammonia may be omitted, but, if it can be obtained, ½ cwt. of muriate of potash or 4 cwt. of kainit should be added; 4 cwt. of salt may be used instead. A sprinkling of nitrate of soda may be given at the time of singling.

In moist districts on heavier soils the turnip crop can do better without farmyard manure than either mangolds or potatoes, and if there is any shortage the following may be used without farmyard manure: 4 to 6 cwt. of superphosphate or basic slag, 1 cwt. of sulphate of ammonia, and 1 cwt. of sulphate of potash in the drills, with 1 cwt. of nitrate of soda as a top dressing at the time of singling.

This dressing (using basic slag and not superphosphate) would also be applied where finger-and-toe is prevalent. It has been shown that this disease is transmitted through dung; the safest way of eradication is to lime the land, and use artificials only for cruciferous crops (turnips, cabbages, etc.) which contract the disease, keeping the farmyard manure for cereals, grass, potatoes, mangolds, etc., which are not liable to infection.

If the climate only allows a crop yield of 15 to 20 tons per acre it is inadvisable to spend too much on manure, as the crop is hardly likely to pay even the cultivation.

Dung will usually be necessary to hold moisture in the soil for the plant: phosphates must be used on heavy land; no loss need be feared, any unused material being kept safely in the soil for the next crop. A small nitrogenous top dressing is desirable only if the plants stand still too long in spring, and run the risk of attack from flea beetles, etc. A suitable dressing is: 10 loads of farmyard manure, with 2 to 4 cwt. of superphosphate.

Cabbages, Brussels Sprouts, Broccoli, etc.—These crops require dung almost more than any other, and in favourable situations they respond also to top dressings of artificials. The dressings recommended for mangolds may be used, but the quantity of nitrate of soda may be increased according to the value of the crops, up to as much as 10 cwt. per acre in extreme cases.

* Basic slag is preferable to superphosphate wherever finger-and-toe is prevalent. In some of the experiments it also gave roots of better feeding value.

	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
Nitrogen from:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sulphate of Ammonia pure.. 95%	16 4	17 0	16 8½	16 6	—	—	17 3	17 9	—	—
Sulphate of Ammonia pure.. 93%	—	—	—	—	17 6	17 5½	17 5½	—	17 3½	17 7
Calcium Cyanamide (Nitrolim)	—	18 2½	15 11½	16 1½	17 9	15 5½	—	—	—	17 4
Nitrate of Soda pure 95%	—	22 1	22 9	—	23 10½	22 5½	22 9	—	22 11	—
Nitrate of Soda pure .. 90%	23 5½	—	24 0	—	—	22 0	—	24 8	23 6	23 2
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—
Soluble Phosphates from:										
Superphosphate 35%	2 8½	2 5	2 8½	3 1½	2 10½	2 9½	2 8½	2 9½	2 9½	2 9½
,, 33%	2 8½	—	2 9½	3 2	—	2 9½	2 8½	2 9½	2 9½	2 9½
,, 30%	2 9½	2 6	2 10½	3 4	3 0	2 10½	2 9½	2 10½	2 10½	2 10½
,, 26%	3 1	2 8½	3 1	3 8	3 3	3 2	3 1	3 2	3 2	3 2
Dissolved Bones.. ..	3 10½	—	3 9½	—	3 11	4 2½	4 1	3 11½	4 1	3 11
Allowed for Nitrogen	*21 1½*	—	*20 8*	—	*21 4*	*22 10½*	*22 2½*	*21 6*	*22 2½*	*21 3*
Allowed for Insol. Phos.	*2 2*	—	*2 1*	—	*2 2*	*2 4*	*2 3*	*2 2*	*2 3*	*2 2*
Insoluble Phosphates (Citric Soluble) from:										
Basic Slag	2 7	—	—	—	—	—	—	—	—	2 8½
Insoluble Phosphates from:										
Basic Slag	—	—	1 9½	—	—	1 8½	—	—	—	—
Bone Meal	1 11½	1 10½	1 10	1 11½	2 1½	2 4	2 4	1 9	1 10½	1 11
Allowed for Nitrogen	*19 1*	*18 5*	*18 2*	*19 5½*	*21 0*	*23 0½*	*23 2*	*17 4½*	*18 2½*	*19 0½*
Steamed Bone Flour..	2 0½	—	2 1	2 1	—	—	—	1 10	—	—
Allowed for Nitrogen	*20 0*	—	*20 3½*	*20 8*	—	—	—	*17 11*	—	—
Potash	No quotations.									

Rape and other Fodder Crops to be fed off by Sheep.—Two rules are important: (1) Phosphates increase the feeding value; (2) Nitrogen increases the bulk.

A suitable dressing is: 4 to 6 cwt. of superphosphate or basic slag, and 1 to 2 cwt. of nitrate of soda or sulphate of ammonia.

For any of the above crops seaweed should be used to supplement the dung if it can possibly be obtained.

Unit Prices of Artificial Manures in April.—The statement on p. 84 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for April, 1916.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

OFFICIAL NOTICES AND CIRCULARS.

Land Settlement of *Discharged Sailors* and Soldiers.

HIS MAJESTY'S Government have had under consideration the Report of the Departmental Committee on the Settlement on the Land of Discharged Sailors and Soldiers.* While recognising that the recommendations made constitute a new departure in the policy of developing small holdings, they have decided to give effect to them by establishing three pioneer colonies as an experimental measure. Sanction will be sought from Parliament for acquiring the land and developing these colonies on the general lines recommended in the Report, and the prospective settlers will be carefully selected from discharged sailors and soldiers by the Board of Agriculture and Fisheries, which will place its services at the disposal of the Statutory Pensions Committee in making provision in the colonies for a certain number of partially disabled men. At the request of Lord Selborne, Captain Charles Bathurst, M.P., has undertaken to devote his whole time to the work of organising these colonies without remuneration, as

* See this *Journal*, February, 1916, p. 1166.

war work, and, with the approval of the War Office, is vacating his appointment on the Staff of the Southern Command accordingly. Mr. Rowland Prothero, M.P., has also agreed to assist him and his officers with his advice.

Delay in Delivery of Agricultural Requisites and Produce.

THE following notice was issued by the Board on 30th March, 1916:—The delays in delivery and transport which are causing great inconvenience to farmers at the present time are due to a variety of causes, such as dislocation of trade leading to scarcity of certain articles, shortage of shipping, shortage of labour at docks and wharves, and on canals, and disturbance of railway traffic.

It is sometimes stated that the difficulties of transport by rail are due to wasteful use of railway trucks for purposes connected with the war, but the use of railway trucks for these purposes is now subject to close supervision, and every effort is being made to ensure economy. The demands, however, of the naval and military authorities on the railway companies are heavy, and with every desire to meet the requirements of agriculture it is impossible that the facilities afforded in normal times can now be maintained.

The situation can be materially improved if consignors and consignees will adjust their arrangements so as to meet the needs of the present situation.

One of the principal causes of delay in transport at present is the consignment of small lots. It is not reasonable to expect that a truck capable of containing, say 8 tons, should be used for a consignment of say 2 tons. Such consignments are necessarily held over till they can be combined with others to make up a reasonable load. Lord Selborne hopes that farmers will consult the public interest as well as their own by ordering, either on their own account or in combination with others, full truck loads of the goods they require to be conveyed by rail. Further, whenever possible, agriculturists should arrange not merely for truck loads made up of a variety of small lots, but for truck loads of goods of one kind.

Delay is caused by the failure of consignors and consignees to load and unload railway trucks promptly. General appeals to traders have already been issued, but Lord Selborne desires to bring this point specially under the notice of farmers, as the saving which could be effected by loading and unloading trucks at country stations at the earliest possible moment would be sufficient to make an appreciable improvement in the position.

The necessity for ordering supplies early is generally recognised. Farmers are, however, reminded at the present time of the need for making early arrangements for the purchase and repair of machines and implements, and also for the purchase of binder twine so as to allow ample time for delivery.

Ordering early, and in truckloads, may involve the necessity for storage. The question of hiring or improvising storage should therefore be kept in view, and in this connection Lord Selborne desires to call attention to the fact that railway companies are prepared to arrange for storage at low rates at many of their stations.

Goods should be ordered from the source of supply which seems to offer the best prospect of reasonable delivery, having regard to the

length and character of the route and other circumstances affecting the question of transport.

Cases of delay in delivery attributed to difficulties of transport have come under the notice of the Board, which, on enquiry, have been found to be due to shortage in, or failure of, the supply of the article ordered. In existing circumstances, farmers may find it worth while, before giving an order for any of the less common feeding stuffs, or any particular brand or quality of the commoner kinds, to ascertain that there is no serious deficiency in the supply of the goods in question.

In the case of basic slag difficulties of transport are accentuated by the fact that this manure is generally produced in districts where the manufacture of large quantities of munitions is now being carried on, and where, in consequence, there is likely to be some congestion and delay of both inward and outward traffic. Lord Selborne recommends farmers to secure supplies of basic slag, as far as possible, during the summer months, when, owing to the longer days, larger traffic can be handled. When storage accommodation is limited, bins should be constructed for the storage of basic slag, ground mineral phosphate, superphosphate, and any other manure, of which it may be desirable to accumulate a stock.

The recent cold wet weather will make quick-acting nitrogenous manures specially valuable this season, and if supplies have not already been secured it is important that sulphate of ammonia should be ordered immediately.

Release of Agricultural Workers for Service in the Army.

The following Circular Letter, dated 25th March, 1916, dealing with the release of agricultural workers for service in the Army, has been addressed by the Board to the Secretaries of the War Agricultural Committees :—

Very urgent and important.

SIR.—1. I am directed by the President of the Board of Agriculture and Fisheries to draw attention to the statement made by the President of the Local Government Board in the House of Commons on the 21st instant, as to the decisions of the Conference at the War Office over which he had presided on the previous day, and to the answer of the Minister of Munitions, speaking on behalf of the Prime Minister, to a question addressed to him by Mr. T. Davies, M.P., in the House of Commons on the 22nd instant.

2. The question and answer were as follows :—

> MR. T. DAVIES : I beg to ask the Minister of Munitions whether, in view of the statement made on behalf of the Government yesterday that still further demands must be made for men upon the agricultural industry, he can make any statement as to the necessity for maintaining agricultural production and retaining on the land a sufficient number of agricultural workers ?
>
> MR. LLOYD GEORGE : It is true, as my hon. Friend says, that it will be necessary in the national interest to review the exemptions granted to certain classes of agricultural workers, but it must not be supposed that in taking this action the Government have failed to realise the importance of maintaining the highest possible output of home-grown food supplies, which remains a national object of a most essential nature. We should deprecate the removal from work on the land of labour which is really essential and irreplaceable for this purpose.

3. I have accordingly to inform you that with the object of insuring that as many as possible of the young unmarried men, who can be spared without serious detriment to essential national services, should be released for service in the Army, a careful revision of the list of Certified Occupations is being made by the Government.

4. Lord Selborne has frequently stated in Parliament and in the communications he has made to farmers, that he has no desire that any man should be retained on a farm who could not be shown to be absolutely indispensable for the cultivation of the farm, and the maintenance of the head of live stock, and in view of the evidence which has reached His Majesty's Government that in certain cases the number of men of military age, who are being retained on the land, is greater than is absolutely essential if full use is made of the services of older men, women and other sources of labour, they have come to the conclusion that some modification of the existing arrangements is necessary and that agriculture in common with other national industries must submit to a revision of the list of Certified Occupations.

5. It has therefore been decided, from and after the 1st May next, to apply this closer scrutiny to the cases of unmarried men who are farm bailiffs, foremen, grieves and stewards, if they are under 30 years of age, and to all other unmarried men who are under 25 years of age. It is not proposed to alter the existing arrangement so far as it relates to the farmers themselves and to the small holders who are included within the definition "farmer (including market gardener and fruit farmer)."

6. It has also been decided that no single man of military age shall continue to be regarded as engaged in a Certified Occupation unless he held his present post, or one of similar character with another employer, previous to the 15th August, 1915.

7. Similar action is being taken in regard to men employed in other industries than agriculture.

8. The effect of these modifications will be that instead of there being a presumption that the men concerned will receive certificates of exemption from military service, unless objection is made by the military representative, *the duty of showing that the men are absolutely indispensable for the cultivation of the farm or the maintenance of the head of live stock will be thrown on the farmers*, and they will have to satisfy the Local Tribunals in each particular case that it is in the national interests that the men should continue in their civil employment.

9. A memorandum embodying the modifications in the existing procedure will be forwarded to you in due course. Meanwhile the present arrangements remain in force.

10. I am to add that Lord Selborne has already made arrangements for the appointment of representatives of the Board who are authorised to appear before the Appeal Tribunals and who will be in a position to see that the facts relevant to a case are placed before the Appeal Tribunals. In view, however, of the modifications in the existing procedure which are referred to above, Lord Selborne thinks it is necessary that the Board should also exercise their right to appoint representatives before the Local Tribunals, *and he will be obliged therefore if the War Agricultural Committee will take immediate steps, through the District Committees or otherwise, to nominate prominent agriculturists to represent the Board before each Local Tribunal.* Lord Selborne recognises that this duty may impose a considerable call upon the time of the persons

undertaking the work, but he would point out that, as no difficulty appears to have been experienced by the War Office in obtaining the services of military representatives, he is confident that suitable persons will be found ready to act as agricultural representatives, more especially in view of the great importance in the national interests of keeping the land of the country in cultivation and of producing the greatest possible amount of food at home as stated in the Prime Minister's reply in the House of Commons. I am to ask that the consent of any persons nominated by your Committee should be obtained and that their full names and addresses with the district for which they will act may be sent to the Board as soon as possible.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Costume for Women Workers on the Land.

IN view of the large number of women who have undertaken to work on the land, and of the need that will arise for suitable clothing, the Board of Agriculture have made arrangements with the Co-operative Wholesale Society, 99, Leman Street, London, E., for the supply to the Women's Farm Labour Committees in England and Wales of any of the following articles at the prices stated :—

	s. d.
Drabett coat, with band, in 2 sizes—	
(*a*) Women's, length 43 in.	
(*b*) Outside women's, length 44 in. ..	9 11 each.
Drabett skirt, in 2 sizes—	
(*a*) Women's, length 31 in., waist 26 in.	
(*b*) Outside women's, length 33 in., waist 30 in.	5 3 ,,
Knickerbockers, in soft drill, in 2 sizes—	
(*a*) Women's, (*b*) Outside women's ..	2 0 per pair.
Overall pinafore, in drabett, with band, for summer wear, in 2 sizes—	
(*a*) Women's, length 41 in.	
(*b*) Outside women's, length 44 in ..	5 11 each.
NOTE.—All the above are washable.	
Boots, black leather, nailed, in sizes 5, 6, 7 ..	6 8 per pair.
Clogs, lined felt, size 5..	4 2 ,,
,, ,, ,, 6 and 7	4 6 ,,
If tipped and ironed, 6*d*. extra per pair.	
Leggings, black leather, height 11¼ and 11¾ in., measurements round calf 13½, 14 and 15 in.	4 0 ,,
Hat, wide straw with white puggaree ..	11½
Sou'wester, black	1 5½

(These prices are subject to fluctuations of the markets and labour difficulties).

The prices quoted are the lowest wholesale terms, and the goods can only be supplied at those prices on the order of the recognised Women's Farm Labour Committee of any county.

All orders must be accompanied by cash.—On receipt of an order from any of the recognised Women's Committees, the Co-operative Wholesale Society will send any of the articles to any address given in

the order. Quantities of not less than *ten* articles will be sent carriage paid. Smaller quantities will be sent carriage forward.

Women who desire to obtain any of the articles of the costume should, therefore, give their orders with the cash price to the Village Regist ars who will forward them to the District Representatives.

The District Representatives would then forward the orders to the Co-operative Wholesale Society, with instructions as to the various addresses to which the goods should be sent.

Armlets for Women Workers on the Land.

THE *President* of the Board of Agriculture and Fisheries has decided to issue an armlet of green baize bearing a red crown to all women who have registered their names as willing to work on the land and who have actually done not less than 30 days' work on the land.

The distribution of the armlets will be entrusted to the District Representatives of the Women's Farm Labour Committees which have been set up in most counties to enlist the services of women on the land, and the District Representatives should send supplies of the armlets to the Village Registrars.

Applications for armlets should be made by women workers to the Village Registrar, who will be expected to satisfy herself before issuing an armlet that the applicant has actually worked on the land for not less than 30 days since the commencement of the war.

District Representatives may apply to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., for the number of armlets required, which will be sent either to them direct or, on their order, to any Village Registrars whose names and addresses are supplied to the Board.

Danish Labour for English Farms.

THE following Notice was issued by the Board on 22nd March, 1916:—The President of the Board of Agriculture and Fisheries is informed that the Central Labour Exchange Department of the Board of Trade, are prepared to try and obtain Danish labour for work on farms in England and Wales, *which are outside the prohibited areas*, provided the Department are assured that engagements for not less than 12 months can be guaranteed, and that the third-class travelling expenses of the men from Denmark will be advanced by the farmers on the understanding that such advances may be recouped by deductions from the wages.

The men would consist mainly of young single men between the ages of 18 and 25, who have had practical agricultural experience, especially in dairy farming, and who have taken a short course at a farm school. They would require to be lodged and boarded under reasonably comfortable conditions, and would have to be paid the current rate of wages for skilled farm workers.

Farmers who desire to obtain Danish labour under these conditions should apply before the end of March to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, S.W., stating the number of men they would engage, and the wages offered, and giving an undertaking that they will advance the travelling expenses of the men, which, in all probability, would not exceed £3.

THE following *Circular Letter*, dated 17th March, 1916, has been addressed by the Board to the Secretaries of War Agricultural Committees :—

Redistribution of Agricultural Labour.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to say that it has been reported to the Board that in certain districts some farms are still carrying practically their ordinary staff, while in other cases the labour has been so depleted as to render it almost impossible to carry on the cultivation of the farms.

Lord Selborne would be glad if, wherever there is any reason to suppose that such conditions exist, the War Agricultural Committees would consider seriously the possibility of initiating and carrying out some scheme for a redistribution of the agricultural labour available in such districts. It is recognised that as any such scheme must be voluntary so far as the farmers and their employees are concerned, and questions of residence may be involved, the matter is one of considerable difficulty; but if it is explained to all concerned that the military authorities will claim for the Army all men liable to military service who are not absolutely essential on a particular farm, farmers and others will recognise that in their own interests, as well as in the interest of home food production, a redistribution of the available labour may be desirable. Farmers who have more skilled men than are absolutely essential under present conditions must be prepared either to give up their surplus labour to the Army, or to agree to its transfer to their neighbours who have insufficient skilled labour to enable them to maintain the production of food on their farms.

Lord Selborne would be glad if you would be good enough to forward for the Board's information a notification of future meetings of your Committee, together with a copy of the Agenda.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

THE following Circular, dated 8th April, 1916, has been addressed to Secretaries of the War Agricultural Committees :—

Irish Migratory Labourers.

Position of Irish Migratory Labourers as to Military Service. Insurance of Women Agricultural Workers.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to say that he has received a number of enquiries with regard to the liability of Irish Migratory Labourers for military service, under the provisions of the Military Service Act, 1916.

This matter was dealt with by the President of the Local Government Board, in the House of Commons on the 22nd of March, 1916, when he stated :—

> "The position of these men is absolutely secure and clear. Any Irish labourers coming over for employment, either on farms or in any other capacity, will not come under the Military Service Act and will not be liable to be called upon for service."

Lord Selborne hopes that your Committee will take the necessary steps to ensure that the position should be made widely known amongst the farmers in your county.

Insurance of Women Workers on the Land.

I am further to say that Lord Selborne has been in communication with the National Health Insurance Commission (England) with reference to the possibility of arrangements being made for the exception

from the provisions of the National Health Insurance Act, 1911, of *women who undertake* work on the land as a temporary measure during the present *national emergency*. The Commissioners have, however, pointed out that such exception can only be made if the class of employment specified is in general a subsidiary occupation and not merely subsidiary in relation to a particular section of the individuals engaged in it, and for this reason it is not possible for women workers on the land to be excepted from the provisions of the Act.

I enclose a copy of a Leaflet* issued by the Commission dealing with the matter. Further copies may be obtained on application to the National Health Insurance Commission, Buckingham Gate, S.W.

The position, therefore, is that while women themselves will in most cases be able to claim individual certificates of exemption, contributions will have to be paid by the farmer or employer, except as regards women who come within the employments specified in paragraph 6 of the enclosed Leaflet.

I am to add that the Welsh Insurance Commission are now preparing a Welsh translation of the Leaflet for distribution in Welsh-speaking districts, and a further communication will be addressed to the Secretaries of War Agricultural Committees in Wales when copies of the Leaflet in Welsh are available.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

National Health Insurance: Women War Workers.

1. EXCEPT in the cases explained below, women undertaking temporary work, in agricultural as much as in industrial employments, come under the provisions of the National Insurance Acts in the same way as regular workers, and the employer is bound to pay contributions in respect of them.

2. Exemption from the payment of the *employed person's* share of the contributions may be granted on one of the grounds named below; such exemption, however, does not relieve the employer of liability for payment of *his* share of the contributions (*i.e.*, in ordinary cases, the weekly threepence).

3. The grounds on which the Acts allow exemption to be claimed are that the claimant (*i.e.*, the worker)—

(1) Is in receipt of any pension or income of the annual value of £26 or upwards, not dependent upon her personal exertions; or

(2) Is ordinarily and mainly dependent for her livelihood upon some other person; or

(3) Is ordinarily and mainly dependent for her livelihood on the earnings derived from an occupation which is not employment within the meaning of the National Insurance Acts.

4. Most of the women who undertake temporary work for the period of the war only could probably come under one or other of the above classes. Thus, women of independent means and soldiers' wives in receipt of separation allowance can claim exemption under Class (1); and women who are living at home, or who are maintained by husband or parents or other relatives can claim under Class (2); while Class (3) would apply in the case of women who are ordinarily dependent upon some profession or occupation which is not an insurable employment. For example, if a woman who ordinarily earns her living by literary or journalistic work, or whose main employment is paid at a rate exceeding £160 a year, temporarily undertakes war work, she would be entitled to claim exemption under Class (3).

* Printed below.

5. A form on which the employed person can claim exemption can be obtained at any Post Office. The application should then be made through the Local Officer of Customs and Excise, whose address will be furnished by the Post Office, and who will render the claimant any necessary assistance in the matter. Further enquiries may be made in the first instance of any such officer, or of the Insurance Commission direct.

6. The "exemption" above referred to must not be confused with "exception." When an employment is **excepted,** the compulsory provisions of the Acts do not apply, so that no contributions are payable either by employer or employed. (The employer's liability under the Workmen's Compensation Act remains.) Certain employments are excepted by Special Order; but the only kinds of employment which the Acts allow to be thus excepted are those which in ordinary cases are subsidiary employments, and not the principal means of livelihood. Among the employments thus excepted are :—Employment as a milker (where the person is not otherwise ordinarily employed by the person for whom the milking is done); or employment on an agricultural holding as a hop-tyer, or (in the case of persons who are not insured at the time of entering the employment) as a flower puller, fruit picker, hop picker, onion peeler, pea picker or potato picker. When, therefore, as will usually be the case, the employment which a woman war worker undertakes consists of the normal duties on which the regular agricultural workers depend for their livelihood, the Acts will not allow of the employment being excepted.

Circular Letter as to Maintenance of Live Stock Order of 1916.

THE following Circular Letter, dated 3rd April, 1916, has been addressed to the County Councils, Borough Councils (including Metropolitan Borough Councils) and District Councils in England and Wales :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's letters of the 21st August and 22nd December last on the subject of the Maintenance of Live Stock Order of 1915, and I am to enclose two copies of an Order* that has been passed to amend it and comes into operation on the 10th April.

Lord Selborne hopes that your Council will take steps to bring the Order to the notice of those concerned by the distribution of the Notice,† of which twenty copies are enclosed, which explains the purport of the Maintenance of Live Stock Order of 1915 as amended by the new Order, or by such other means as your Council may consider to be desirable. Further copies of the Order and of the Notice will be supplied on receipt of an application to the Secretary of the Board.

The new Order amends the existing Order in three respects :—

1. The exemption provided by Art. 2 (2) for calves bred from cows of prescribed dairy breeds has been deleted owing to the fact that to a considerable extent the exemption has led to evasion of the Order.

2. The price limit of 30*s.* prescribed by Art. 2 (3) has been raised to 40*s.*

This has been done to meet strong representations that the 30*s.* limit affects adversely the breeder to the benefit of the dealer and the butcher, and that it also encourages the undesirable but long established practice of sending calves to markets when a few days old. Lord Selborne is satisfied that the limit of price can be raised without any substantial risk of increasing the slaughter of calves

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* Not printed. † Printed below.

that can profitably be reared, and he has decided to increase the limit to 40s.

3. Provision has also been made for the slaughter of calves in districts where markets are closed owing to *Foot-and-Mouth Disease* restrictions.

I am to add that the amendments to the existing Order have been made after consultation with, and with the approval of, the Board's Agricultural Consultative Committee, and Lord Selborne hopes that your Council will be good enough to give the necessary instructions to secure effective administration of the Orders.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Maintenance of Live Stock Order of 1915 as amended by the Maintenance of Live Stock Order of 1916.

Restriction of Slaughter of In-calf and In-pig Animals and of Calves.—These Orders prohibit, with certain exceptions, the slaughter of—

(1) Animals visibly or obviously in-calf or in-pig; and

(2) Calves in which the first permanent molar or grinder tooth is not cut and visible, which for practical purposes means calves which are not six months old.

Exceptions.—The Orders allow the slaughter of a calf of any breed which has been offered for sale by public auction at any market or sale yard in England, Wales or Scotland, without reserve or subject to a reserve price of forty shillings or less, and for which no bid exceeding forty shillings has been made on such occasion; but this provision has effect only:—

(*a*) If the calf so offered for sale is before movement from the market or sale-yard marked with a broad arrow by, or under the direction of, the auctioneer in the manner prescribed by the Orders; and

(*b*) If such mark is on the calf at the time of slaughter.

The Orders allow the slaughter of an in-calf or in-pig animal or of a calf, if slaughter is necessary or desirable on account of (1) accidental injury to the animal or its illness, or (2) if the slaughter of the animal is licensed by the Board for an exceptional reason or purpose. Applications for these licences may be made in writing to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

The new Order came into force on the 10th April, 1916.

Offences.—Contraventions of the Orders, or the marking of an animal or alteration or obliteration of a mark with a view to evade the operation of the Orders, or the obstruction of an officer in the execution of his powers or duties is punishable by a fine of £20.

Sulphate of Ammonia.

THE returns received from makers of sulphate of ammonia during the past two months have not shown that substantial increase in the demand by farmers for sulphate of ammonia which was anticipated. It has, therefore, been decided to recommence the consideration of applications for export as from the beginning of April. The necessity of meeting the requirements of our Allies, the importance in the national interests of maintaining the very valuable export trade in this article, and the necessity of avoiding any risk of interfering with the output of munitions by reason of congestion at the sulphate of ammonia works are the main considerations which, in the absence of an agricultural demand equal to the supply, have rendered this course inevitable. Steps will, however, be taken so to regulate the quantity allowed to be exported as to ensure that an ample supply is reserved to meet the needs of agriculture during the next two months.

MISCELLANEOUS NOTES.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural and Commercial Statistics* for March, 1916, issued by the International Institute of Agriculture, contains estimates of the production of cereal crops in the Southern Hemisphere.

The production of wheat in *Argentina* in 1915-16 is placed at 21,575,000 qr., against 21,053,000 qr. in 1914-15, or an increase of 2·5 per cent. The production of oats is estimated at 7,719,000 qr. against 5,870,000 qr. in the previous year, or an increase of 31·5 per cent.

The total production of wheat in *Argentina*, *Uruguay*, *Australia* and *New Zealand* is estimated at 41,736,000 qr. in 1915-16, against 25,415,000 qr. in 1914-15, or an increase of 64·2 per cent.

In the Northern Hemisphere the production of cereal crops in Sweden is given as follows: *Wheat*, 1,146,000 qr. in 1915, against 1,059,000 qr. in 1914, an increase of 8·2 per cent.; *rye*, 2,696,000 qr., against 3,219,000 qr., a decrease of 16·2 per cent.; *barley*, 1,710,000 qr., against 1,463,000 qr., an increase of 16·9 per cent.; *oats*, 9,363,000 qr., against 5,389,000 qr., an increase of 73·7 per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown with winter *wheat* in 1915-16, compared with the areas sown during the corresponding period of 1914-15, expressed as percentages, are as follows: Denmark 100, France 91, England and Wales 94, Rumania 101, Switzerland 107, Canada 85, United States 89, India 95; with *rye*: Denmark 100, France 89, Rumania 116, Switzerland 105, United States 97; with *barley*: Denmark 100, France 67, Rumania 92, Switzerland 103; with *oats*: Denmark 100, France 88.

Russia—According to a report of the Department of Rural Economy and Household Statistics, as to the state of the crops up to 23rd February, there are few definite indications of damage to the winter-sown crops from frosts; although the weather during the first half of the winter was not favourable to the growing crops. Probably, therefore, the condition of the crops is approximately the same as on 1st November last, when the winter sowings, with the exception of the late sowings in the south, were quite satisfactory in the whole of European Russia. (*Broomhall's Corn Trade News*, 25th March.)

India.—According to the Second Government Forecast the area sown with wheat in 1915-16 is 30,227,000 acres as compared with 32,230,000 acres—the final estimate last season; linseed, 2,763,000 acres against 2,709,000 acres; and rapeseed, 3,629,000 acres against 4,174,000 acres in 1914-15. The prospects for the wheat crop generally vary from fair to good. In the western districts of the United Provinces the linseed and rapeseed crops have suffered from frosts and drought, and a yield only 60 to 80 per cent. of an average is expected, but in other parts of the country prospects are generally fair to good. (*London Grain, Seed, and Oil Reporter*, 13th and 18th March.)

New Zealand.—According to a report issued by the Census and Statistics Office on the 14th February, the estimated production of wheat and oats in New Zealand this season is as follows:—Wheat, 7,309,020 bush. as compared with 6,644,336 bush. in 1914-15, and oats, 12,722,733 bush. against 11,436,301 bush. in the previous season.

South Africa.—The official report for January, published on the 16th February, states that the total production of maize in South Africa is expected to be slightly greater than last season, but the present drought is causing much anxiety, and, unless adequate rains fall soon, a large reduction on last season's production is probable. (*Broomhall's Corn Trade News*, 25th March.)

The Agricultural Department reports that, owing to the drought, there will be a shortage of 2,000,000 bags of maize, and no export is expected. (*The London Grain, Seed and Oil Reporter*, 25th March.)

Agricultural Conditions in England and Wales on 1st April.

THE crop reporters of the Board, in reporting on agricultural conditions in England and Wales, state that the very wet and stormy weather, which was accompanied by much snow, has caused great delay in all agricultural operations. The early-sown winter wheat has generally withstood the bad conditions well, and is satisfactory, though it has made no progress during the month and is mostly backward. Wheat on heavy land, or on land subject to flooding, has, however, suffered a good deal, while that sown late in the autumn is also not satisfactory. The area under wheat appears to be about 7 or 8 per cent. less than last year. Winter oats and beans are mostly healthy and promising crops, although backward, but there are a good number of exceptions, especially in the west.

Preparation of the land for the spring crops was almost at a standstill during the month, and very little corn indeed was sown, none at all being got in in most counties. Similarly, only in one or two very favoured districts have a few early potatoes been planted.

Seeds are generally strong and vigorous, promising a good or abundant yield, more particularly on the eastern side of the country; in some parts the wet has done some harm, and reports from the north-west are not so favourable as elsewhere.

There has been a good fall of lambs. The abnormally bad weather has resulted in the ewes being only in poor condition, and in many parts they are not milking well. The lambs were generally strong and healthy at birth, but the conditions have been so adverse, that altogether losses have probably been rather over average.

Agricultural Labour in England and Wales during March.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st April, labour was everywhere very deficient, and with considerable arrears to be made up, many farmers will be hard put to it to get the work done this spring.

The following summaries give details regarding the different districts :—

Northumberland, Durham, Cumberland, and Westmorland.—With little work on the land possible, the shortage in the supply of labour was not much felt during March, but men were very scarce, and the scarcity will be keenly felt when the weather improves.

Lancashire and Cheshire.—Labour was everywhere deficient, but the shortage was not so much felt owing to the bad weather hindering farming work. It was anticipated that there will be a shortage for potato planting.

Yorkshire.—The supply of labour was very short, and it will be keenly felt when work on the land is possible, as spring work is very backward.

Shropshire and Stafford.—Labour continued to be very scarce throughout the division.

Derby, Nottingham, Leicester, and Rutland.—Labour was very short throughout the district.

Lincoln and Norfolk.—The supply of labour was deficient throughout the division, and it was stated that the scarcity would be more felt

during April. Wages have advanced 2s. per week.

Suffolk, Cambridge, and Huntingdon.—The deficiency in the supply of labour was not much felt during March, as little work was possible, but men were very scarce, and with such a late season, farmers will have difficulty in sowing all their land.

Bedford, Northampton, and Warwick.—Farm labourers got more scarce, and with work very much in arrear the outlook is disquieting.

Buckingham, Oxford, and Berkshire.—Labour was generally very deficient, especially in view of the arrears to be made up; milkers were scarce in north Buckingham.

Worcester, Hereford, and Gloucester.—The supply of labour was everywhere short, but the deficiency was not so much felt owing to the impossibility of working on the land.

Cornwall, Devon, and Somerset.—The supply of labour was very short, and at the Lady-day hirings wages rose by 2s. to 3s. per week in many districts. The deficiency was expected to be more severely felt with improved weather.

Dorset, Wiltshire, and Hampshire.—Labour was very scarce and was becoming more so, and it was anticipated that farmers will have great difficulty in getting their spring sowing done. Wages showed an upward tendency.

Surrey, Kent, and Sussex.—The supply of labour was very short, and farmers were getting anxious as work was very much behind. Wages were increased in some localities during the month.

Essex, Hertford, and Middlesex.—There was no great demand for labour, as little field work was possible, but there was a very short supply, and the shortage will be keenly felt when the land dries.

North Wales.—The supply of labour was very deficient, especially casual labourers, and with the weather improving the scarcity was being keenly felt.

Mid Wales.—Labour was still very scarce, and the lack of both skilled and unskilled hands was beginning to be more severely felt.

South Wales.—Labour was very deficient, and the outlook was considered serious.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st April, 1916, certain diseases of animals existed in the countries specified:—

Austria (on the 8th March). — Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of Feb.).—Anthrax, Foot-and-Mouth Disease (118 outbreaks), Swine Erysipelas, Swine Fever.

France (for the period 5th—18th March).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—29th Feb.).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of Feb.).—Anthrax, Foot-and-Mouth Disease (46 outbreaks) Foot-rot, Swine Erysipelas.

Hungary (on the 8th March).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 6th—12th March).—Anthrax, Blackleg, Foot-and-Mouth Disease (1,692 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of Feb.).—Anthrax, Blackleg.

Rumania (*for the period* 21*st*—29*th Feb.*).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies. Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (*month of Oct.*).—Anthrax, Foot-and-Mouth Disease (259,789 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of Dec.*).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of Feb.*).—Anthrax, Blackleg.

Switzerland (*for the period* 13*th*—19*th March*).—Anthrax, Blackleg, Foot-and-Mouth Disease (9 " étables " entailing 164 animals, of which 5 " étables " were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries :—Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during March.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending Mar. 4th :								
England, N.E. ...	36·7	—2·0	1·07	27	+18	7	2·3	— 0·7
England, E.	37·1	—1·8	0·75	19	+10	6	2·1	—0·9
Midland Counties ...	34·7	—4·2	1·00	26	+15	5	1·6	—1·1
England, S.E. ...	36·9	—3·1	1·19	30	+18	5	1·9	—1·2
England, N.W. ...	36·0	—3·6	0·74	19	+ 5	5	2·4	—0·4
England, S.W. ...	35·3	—5·8	0·79	20	+ 2	4	3·0	—0·1
English Channel ...	39·2	—4·7	1·55	39	+24	6	2·6	—1·2
Week ending Mar. 11th :								
England, N.E. ...	34·6	—5·1	0·96	24	+13	7	1·8	—1·6
England, E.	34·4	— 5·3	0·80	20	+11	7	1·3	—2·1
Midland Counties ...	33·8	—6·0	0·57	15	+ 4	6	1·4	—1·6
England, S.E. ...	34·9	— 6·0	0·64	16	+ 5	5	2·1	—1·2
England, N.W. ...	35·3	—4·9	0·18	4	— 10	4	2·3	— 0·7
England, S.W. ...	34·6	—7·1	0·35	9	— 8	4	3·3	—0·1
English Channel ...	38·9	—4·7	0·53	13	— 2	5	4·0	—0·2
Week ending Mar. 18th :								
England, N.E. ...	38·2	—2·6	1·01	26	+15	6	0·7	—3·3
England, E.	41·8	+0·9	0·48	12	+ 4	5	0·7	—3·3
Midland Counties ...	40·3	—0·8	1·14	29	+20	5	0·7	—2·7
England, S.E. ...	44·3	+2·2	0·58	15	+ 5	5	1·7	—2·1
England, N.W. ...	40·3	— 0·9	0·53	14	+ 1	4	1·7	—1·7
England, S.W. ...	42·5	0·0	0·59	15	+ 1	5	2·6	—1·3
English Channel ...	46·3	+1·1	1·25	32	+20	6	3·2	—1·6
Week ending Mar. 25th :								
England, N.E. ...	37·3	—4·2	0·68	17	+ 8	6	1·5	—2·8
England, E.	39·8	—2·0	0·72	18	+ 9	5	1·8	—2·5
Midland Counties ...	38·5	—3·3	1·11	28	+19	5	1·4	—2·5
England, S.E. ...	41·2	—1·8	1·15	29	+19	6	2·0	—2·3
England, N.W. ...	38·2	—3·8	0·86	22	+ 9	5	1·5	— 2·4
England, S.W. ...	40·9	—2·6	1·12	29	+14	5	2·5	—1·9
English Channel ...	44·1	—1·7	0·53	13	+ 1	5	3·1	—2·1

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	51	53	168	208
Animals attacked	65	53	193	228
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	6	—	19	7
Animals attacked	16	—	60	11
Parasitic Mange:—				
Outbreaks	224	* —	1,011	* —
Animals attacked	514	* —	2,507	* —
Sheep-Scab:—				
Outbreaks	17	27	149	134
Swine Fever:—				
Outbreaks	374	256	1,078	947
Swine Slaughtered as diseased or exposed to infection	1,210	1,131	3,376	3,968

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	1	1	1
Animals attacked	—	1	5	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	4	3	22	13
Sheep-Scab:—				
Outbreaks	30	44	172	175
Swine Fever:—				
Outbreaks	23	26	59	65
Swine Slaughtered as diseased or exposed to infection	189	159	294	407

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in March and February, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	March.		February.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	12 1	11 8	11 9	11 2
Herefords	12 6	11 4	11 8	10 7
Shorthorns	12 1	11 2	11 7	10 8
Devons	12 1	10 11	11 8	10 4
Welsh Runts	11 10	11 2	11 4	10 10
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10½	9¼	—	9½
Sheep:—				
Downs	13¼	12¼	12½	11¼
Longwools	12½	11¼	12	10¾
Cheviots	14¼	12¾	13¼	12
Blackfaced	14	12¼	13	11½
Welsh	12¾	11½	11¾	10¾
Cross-breds	13½	12¼	12¾	11½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	11 11	11 2	11 1	10 4
Porkers	12 10	12 1	11 11	11 3
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—*In Milk* ...	29 19	24 3	29 14	24 3
,, —Calvers ...	29 1	23 7	29 7	23 19
Other Breeds—In Milk ...	25 19	22 4	27 4	23 6
,, —*Calvers* ...	22 10	19 0	—	20 0
Calves for Rearing	2 16	2 3	2 17	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	13 10	11 11	13 6	11 7
,, —Two-year-olds...	18 9	16 6	17 18	16 4
,, —Three-year-olds	24 16	20 7	23 18	20 14
Herefords —Two-year-olds...	20 14	17 11	20 1	16 11
Devons— ,,	20 5	17 1	18 17	16 11
Welsh Runts— ,,	18 6	16 1	18 15	17 5
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	65 5	54 9	58 6	51 1
Store Pigs:—				
8 to 12 weeks old	28 9	22 5	26 11	20 1
12 to 16 weeks old	45 11	35 8	46 5	35 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in March, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—											
English	1st	82	0	79	6	—		82	0	81	6
	2nd	78	0	76	6	—		77	6	77	0
Cow and Bull	1st	76	0	74	0	72	0	73	6	74	0
	2nd	70	6	69	0	62	6	68	6	69	0
Irish : Port Killed	1st	79	6	76	0	79	0	80	0	79	6
	2nd	74	6	71	6	74	6	76	6	76	0
Argentine Frozen—											
Hind Quarters	1st	71	6	71	0	70	0	72	6	70	0
Fore ,, ...	1st	60	6	58	6	60	6	60	6	60	6
Argentine Chilled—											
Hind Quarters	1st	80	6	78	0	78	6	78	6	78	6
Fore ,, ...	1st	66	6	64	6	66	0	65	0	66	0
Australian Frozen—											
Hind Quarters	1st	65	6	—		69	0	—		69	0
Fore ,, ...	1st	56	0	—		61	6	—		61	6
VEAL :—											
British	1st	—		—		—		108	6	—	
	2nd	94	6	—		80	6	99	0	79	6
Foreign...	1st	—		—		—		115	0	—	
MUTTON :—											
Scotch	1st	101	6	102	6	109	6	107	0	112	6
	2nd	97	0	98	0	101	6	100	0	107	0
English...	1st	101	6	102	6	—		101	0	106	6
	2nd	97	0	98	0	—		94	6	100	0
Irish : Port Killed	1st	98	0	—		102	0	—		101	6
	2nd	—		—		97	6	—		97	0
Argentine Frozen	1st	80	6	80	6	81	0	82	0	81	0
Australian ,, ...	1st	76	0	81	6	77	0	76	0	77	0
New Zealand ,, ...	1st	77	0	80	6	—		80	0	—	
LAMB :—											
British	1st	125	0	—		—		119	6	—	
	2nd	121	6	—		—		110	0	107	6
New Zealand	1st	88	0	84	6	88	0	87	6	88	0
Australian	1st	86	0	84	6	83	6	84	6	83	6
Argentine	1st	86	6	86	6	85	0	85	0	85	0
PORK :—											
British ...	1st	104	0	99	0	102	6	100	6	101	6
	2nd	99	6	93	6	95	6	91	0	95	0
[illegible]	1st	76	0	76	6	77	0	78	6	77	6

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AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in March, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	19 9	18 9	—	—	18 6	17 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	137 0	128 0	137 6	128 0	—	—
Danish...	—	—	181 6	179 6	180 6	177 0
French...	—	—	—	—	160 0	154 0
Russian	130 6	122 0	—	124 6	134 0	126 0
Canadian...	—	—	—	—	—	—
Australian	160 6	155 6	160 0	158 0	161 6	156 6
New Zealand	167 0	164 0	167 6	165 6	165 6	161 6
Argentine	157 0	153 0	155 6	153 0	157 0	152 0
CHEESE:—						
British—						
Cheddar	109 0	104 6	111 0	108 0	110 6	105 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	123 6	118 6	126 0	119 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	103 0	99 0	103 6	99 6	103 6	101 0
BACON:—						
Irish (Green)	107 6	102 6	106 0	101 0	106 6	102 0
Canadian (Green sides)	94 6	90 0	93 6	88 6	95 0	90 0
HAMS:—						
York (Dried or Smoked)	155 0	148 6	—	—	156 6	149 6
Irish (Dried or Smoked)	—	—	—	—	145 0	138 6
American (Green) (long cut)	85 0	80 0	84 0	80 0	86 0	82 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	16 3	—	—	—	17 6	16 5
Irish	15 3	—	15 1	14 2	16 2	15 6
Danish	—	—	—	—	18 5	16 5
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen ...	101 0	86 0	—	—	109 0	99 0
Edward VII.	112 6	100 0	91 6	80 0	106 6	98 0
Up-to-date	104 6	92 0	90 0	83 6	103 6	95 0
HAY:—						
Clover	—	—	170 0	130 0	137 0	129 0
Meadow	—	—	—	—	135 0	125 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 8 ...	30	11	46	2	55	8	25	11	29	7	47	8	18	4	26	5	31	5
„ 15 ...	31	0	48	9	56	7	26	0	30	5	48	6	18	6	27	6	31	11
„ 22 ...	30	11	51	6	57	2	26	3	31	3	49	6	18	11	28	10	32	6
„ 29 ...	31	1	52	8	58	0	26	6	32	5	51	0	19	1	29	10	32	11
Feb. 5 ...	31	0	53	3	58	3	26	7	33	7	52	5	18	9	30	3	32	4
„ 12 ...	31	0	54	8	57	6	26	7	34	7	52	10	18	11	31	1	32	2
„ 19 ...	31	0	56	0	56	11	26	7	34	11	53	6	18	11	31	5	31	9
„ 26 ...	31	0	56	0	58	2	26	6	35	3	54	2	18	11	31	8	32	2
Mar. 4 ...	31	5	55	11	59	4	26	2	34	6	55	7	18	9	31	8	32	4
„ 11 ...	31	6	54	8	58	2	26	0	33	5	55	6	18	7	31	0	32	3
„ 18 ...	31	5	53	9	57	9	25	8	32	2	55	4	18	6	30	7	31	10
„ 25 ...	31	4	54	3	55	11	25	7	31	11	54	6	18	8	30	6	31	4
Apl. 1 ...	31	6	54	6	53	6	25	6	31	9	53	8	18	5	30	6	30	5
„ 8 ...	31	5	54	9	51	8	26	8	31	3	53	7	18	4	30	4	30	1
„ 15 ...	31	7	55	4			25	4	30	10			18	4	30	5		
„ 22 ...	31	9	56	5			26	6	31	5			18	5	30	11		
„ 29 ...	31	9	58	3			26	0	32	7			18	5	31	5		
May 6 ...	32	2	60	5			25	6	33	3			18	9	32	4		
„ 13 ...	32	7	61	7			26	3	34	0			18	11	32	5		
„ 20 ...	33	0	62	0			25	10	34	1			19	0	32	8		
„ 27 ...	33	9	61	11			26	1	34	8			19	4	32	7		
June 3 ...	34	0	61	9			25	11	35	4			19	4	32	5		
„ 10 ...	34	1	60	1			24	11	34	5			19	8	32	4		
„ 17 ...	34	1	56	1			25	10	34	3			19	9	31	9		
„ 24 ...	34	3	52	0			25	4	34	4			20	0	31	9		
July 1 ...	34	4	49	5			24	6	35	3			19	9	31	1		
„ 8 ...	34	2	50	1			24	9	34	7			20	0	31	6		
„ 15 ...	34	1	52	7			24	2	35	8			19	10	31	6		
„ 22 ...	34	0	53	10			24	7	35	10			19	9	32	1		
„ 29 ...	34	2	55	3			25	9	36	1			19	8	31	1		
Aug. 5 ...	34	9	55	4			25	2	35	7			19	1	31	5		
„ 12 ...	40	3	55	2			29	4	37	0			25	1	31	7		
„ 19 ...	38	9	54	3			29	10	39	4			24	3	31	4		
„ 26 ...	36	2	51	11			30	3	38	3			23	5	30	0		
Sept. 2 ...	36	5	45	3			30	6	38	1			23	9	26	10		
„ 9 ...	37	10	43	0			29	11	37	11			23	11	26	8		
„ 16 ...	38	3	42	9			29	5	39	0			23	8	26	4		
„ 23 ...	37	6	43	3			29	3	39	8			23	3	26	1		
„ 30 ...	37	1	43	5			29	1	40	4			22	9	26	5		
Oct. 7 ...	36	8	44	1			28	10	41	0			22	5	26	5		
„ 14 ...	36	7	45	9			28	8	42	3			22	4	27	1		
„ 21 ...	37	2	48	2			28	7	44	0			22	5	28	1		
„ 28 ...	37	10	50	3			28	3	46	2			23	7	29	1		
Nov. 4 ...	38	8	51	6			28	6	47	3			23	7	30	4		
„ 11 ...	39	8	52	8			29	0	47	5			24	8	30	11		
„ 18 ...	41	0	53	6			29	8	47	11			25	5	31	3		
„ 25 ...	41	11	54	2			30	3	48	7			25	8	31	1		
Dec. 2 ...	42	2	53	7			30	2	48	11			25	9	30	11		
„ 9 ...	42	1	52	10			29	11	47	10			25	9	30	4		
„ 16 ...	42	7	53	11			29	8	47	5			25	9	30	6		
„ 23 ...	43	3	53	10			29	9	47	2			25	11	30	7		
„ 30 ...	44	4	54	9			29	10	47	5			26	6	30	10		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats,

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of March, 1914, 1915, and 1916.

—	Wheat.						Barley.						Oats.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
London ...	32	5	56	5	57	0	24	10	33	0	53	11	19	4	32	6	32	8
Norwich ...	31	1	54	5	56	3	25	7	33	9	55	2	18	0	31	1	31	3
Peterborough	30	11	53	11	55	5	25	3	31	10	53	8	18	2	30	9	31	3
Lincoln ...	31	8	55	3	57	5	26	2	30	11	54	0	19	5	30	5	31	9
Doncaster ...	31	7	53	4	57	9	25	2	30	8	52	9	18	9	29	7	31	5
Salisbury ...	30	7	53	4	56	11	25	6	33	11	53	8	18	3	33	4	31	0

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Horticulture—

Moody, J. F.—The Pruning of Fruit Trees. (135 pp.) Western Australia: Government Printer, 1912. 3s. 6d. [63·41-195.]

Plant Diseases—

McAlpine, D.—Bitter Pit Investigation: The Past History and Present Position of the Bitter Pit Question. First Progress Report, 1911-12. (197 pp. + XXXIII. plates.) The Cause of Bitter Pit: Its Contributing Factors. Second Progress Report, 1912-13. (224 pp. + LX. plates). Melbourne: Government Printer. [63·21.]

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Chelmsford, East Anglian Institute of Agriculture.—Composition and Food Units of Food Stuffs analysed at the above Institute. Chelmsford 1915. [63.604(*a*).]

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Penlington, W. A. G.—Science of Dairying: A Text-book for the Use of Secondary and Technical Schools. (260 pp.) London: Macmillan & Co., 1915. 2s. 6d. net. [63.70(02).]

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IDENTIFICATION OF THE COUNTRY OF ORIGIN OF COMMERCIAL OATS.

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INVESTIGATIONS were started in 1913 with a view to the identification of the country of origin of commercial samples of oats. The method employed has been the same as that adopted by Saunders[1], that is to say, the seeds of weeds and of cultivated plants met with in samples from various countries have been identified and tabulated.

The grain has also been carefully examined, and although fairly constant differences are to be seen in the quality and other characteristics of the oats themselves, these would not seem to afford sufficient evidence for a definite pronouncement as to the origin of the samples.

The 81 samples upon which this report is based included grain harvested in 1911, 1912, 1913, and 1914, and were obtained through the Board of Agriculture and Fisheries from nine different sources.

The origin of the samples was as follows:—Russia, 24; Germany, 13; Argentina, 11; Canada, 8; New Zealand, 7; Chile, 6; United States, 5; Scotland, 5; and Turkey, 2. In addition, a considerable number of English and Welsh samples have been examined.

Examination of Grain.—1. *Great Britain.*—On the average these were the heaviest and best samples, and, with those from New Zealand, were the cleanest.*

2. *New Zealand.*—These, on the average, were clean and uniform samples; one sample showed signs of being cut too early and another of having been "heated"; all the samples were "white" oats.

* Clean with reference to grit and other inert matter; weeds are not

3. *Canada.*—Most of the samples suggested rather early cutting; the samples were mostly "white," containing a few "black" grains.

4. *Germany.*—"White" and "tawny" samples were received, of which the "white" appeared to be the better; about equal in quality to grain from Canada.

5. *United States.*—Many of the samples were thin and of low bushel weight, and were frequently "clipped."

6. *Chile.*—Contained many unfilled husks, and consequently of rather low bushel weight. Most of the samples were "white" and "grey" mixed. All contained moderate quantities of wheat, which would add to their feeding value rather than the reverse.

7. *Russia.*—Frequently "clipped"*; the samples were of poor bushel weight and often contained much earth.

8. *Turkey.*—Contained more weeds and more earth† (comparatively large stones and pieces of earth being frequent) than the Russian; otherwise of very similar quality.

9. *Argentina.*—Badly filled grain very prevalent, and decided evidence of forced ripening; nearly all the samples were mixed "white," "grey," and "black."

The above statement places the samples approximately in their order of merit. Fairly good individual samples were, however, met with from all the countries, with the possible exception of Argentina.

Sufficient samples were received from Russia alone for the purpose of fairly contrasting the quality of the grain obtained from different harvests; on the average the 1912 samples were better than those of other years.

Reference to the statistics of the Board of Agriculture and Fisheries gives further evidence as to the quality of the grain from the different countries. Table I. (p. 107) shows the average figures as to money value given for the four years 1911-1914 inclusive.

It will be noted that the average value of the samples coincides fairly closely with the average quality as determined by inspection. The apparently poor quality of the United States samples is probably in part accounted for by the fact that the samples examined were from the 1913 harvest, when grain from the United States fell below its average value.

Saunders also places the quality of Canadian oats from the 1912 harvest above that of those from the United States for that year; and this is borne out by the value of the respective samples.

* cf. Saunders[1], p. 40. † cf. Saunders[1], p. 48.

Money value and quality are probably not absolutely synonymous, since differences in price may often to some extent be due to variations in freightage. The figures in the table below are, however, significant, especially perhaps the considerable variation in the relative position of the countries, and the wide fluctuations in value, from year to year, which are more particularly to be seen in the samples from the United States, Germany, Netherlands, and Australia (although these last always command a high price).

TABLE I.

Showing the value of Oats from various Over-sea Countries, as declared by the Importer at the time of entry into Great Britain. (The figures are collated from "Agricultural Statistics," Part IV., for 1912 and 1914.)

Countries placed in order of Average Value of Grain (1911–1914 inclusive).	Average Value per qr. for the four years 1911–1914.	Differences between Highest and Lowest Average Value for the four years.	Relative Average Value of Grain in each of the four years. (1=most valuable; 13=least valuable.)			
			1911.	1912.	1913.	1914.
	s. d.	*s. d.*				
New Zealand*	23 10	1 6	—	2	1	1
Australia*	22 8	4 4	—	1	2	4
British South Africa†	22 0	3 7	—	4	—	2
United States of America	19 6	4 9	2	8	5	3
Canada	18 9	2 11	4	5	6	5
Germany	18 9	4 8	1	3	3	7
Chile	18 0	3 2	9	7	4	6
Russia	17 7	3 4	7	6	9	8
Netherlands	17 3	4 2	3	8	7	13
Turkey in Asia	17 1	2 0	8	11	8	10
Turkey in Europe	16 10	2 9	4	13	10	12
Rumania	16 10	2 5	6	11	12	8
Argentina	16 4	3 4	10	10	11	11

* The figures for New Zealand and Australia are averaged for the three years 1912, 1913, and 1914 only.

† The figures for British South Africa are averaged for the two years 1912 and 1914 only.

It will be observed that the Argentine grain always takes a low position; the same is true of the Turkish (with a single exception (*i.e.*, 1911) in favour of Turkey in Europe). The Russian and Rumanian oats are fairly constant and do not attain to a high position. Samples from the United States, Canada, and Germany, to a less extent from Chile, and occasionally from the Netherlands, may reach a high position, but vary very considerably, relatively to each other, from year to year. The New Zealand, Australian, and British South African oats would seem always to command a high price, and it is invariably left to one of these to head the list.

Since the money values of the oats and their quality estimated by inspection are in the main corroborative, it would seem to

be certain that the feeding value of the samples depends both upon the country of origin and upon the harvest.

Australian and British South African grain is probably always desirable. Samples from Argentina would seldom seem to be satisfactory, whilst high grade samples are not generally to be looked for from Turkey, Rumania, Russia, or the Netherlands. Good samples may be expected from the United States, Germany, and Canada, and, to a less extent, from Chile, but in any particular year, oats from the United States, Germany and Canada may be the better grain. It is, therefore, important that the farmer should follow the prices from year to year, and that he should have some means of knowing if the grain he purchases has come from the country he desires.

Included Seeds.—(*a*) GENERAL.—On the average the Russian samples examined by the writer, like those studied by Saunders, contained the largest quantity, and generally the greatest variety, of weeds. The Turkish samples would seem to be equally impure. The rest followed in turn (impure to clean) approximately thus:—Argentina and Chile; Germany; Canada and United States; Great Britain; New Zealand.

TABLE II.

Showing distribution of Seeds of Cultivated Plants in samples of Oats from various Countries. The figures denote number of occurrences per ten samples, calculated to nearest whole number.

PLANT.	Russia.	Germany.	Turkey.	New Zealand.	U.S.A.	Canada.	Argentina.	Chile.	Great Britain.
Wheat (*Triticum* sp.)	3	5	5	5	4	7*	6	10*	2
Barley (*Hordeum vulgare et H. hexastichum*)	6	7	5	–	3	7	8	1	8
Rye (*Secale cereale*)	1	–	–	–	–	–	–	–	–
"Brown" Oat (*Avena strigosa*)	–	–	–	–	–	–	–	–	2‖
Indian Corn (*Zea Mays*)	2	–	–	–	7	–	5	–	–
Millet (*Panicum miliaceum*)	6	2	4	–	–	–	–	–	–
Pea (*Pisum sativum*)	1	2	–	–	–	–	–	–	–
Vetch (*Vicia* sp.)	8	5	4	–	1	–	–	2	–
Soy Bean (*Glycine* sp.)	–	–	–	–	–	–	7	–	–
Serradella (*Ornithopus sativus*)	–	3	–	–	–	–	–	–	–
Field Bean (*Vicia Faba*)	–	2	–	–	–	–	–	–	–
Chick Pea (*Cicer arietinum*)	–	–	–	–	–	–	2	–	–
A Legume (not yet identified)	–	–	5	–	–	–	–	–	–
Linseed (*Linum usitatissimum*)	2	1	–	–	–	8	4	2	–
Buckwheat (*Fagopyrum* sp.)	2	‡	–	–	–	†	–	–	–
Sunflower (*Helianthus annuus*)	1	–	–	–	§	–	–	–	–
Hemp (*Cannabis sativa*)	2	–	–	–	–	–	–	–	–

* Including *Triticum Spelta*.
† Saunders[1] quotes Mr. A. Eastham thus: "Rough Seeded Buckwheat ... is commonly found mixed with Oats from Quebec province."
‡ Saunders[1] finds Buckwheat occasionally present in German samples.
§ Sunflower may be expected in samples from the United States.
‖ *Avena strigosa* in some Scotch and some Welsh samples.

(*b*) SEEDS OF CULTIVATED PLANTS.—The distribution of these seeds, shown in terms of the number of occurrences for ten samples, is set out in Table II.

It will be seen by reference to that table that the following points of difference are to be noted:—

Wheat and barley are generally to some extent present in all the samples. Barley is, however, very rare in the Chilian samples (merest traces of 6-rowed barley being found in one sample only). The New Zealand samples were so pure generally that the absence of barley should probably not be taken as a diagnostic feature.

The samples from Argentina, like those from the United States, frequently contained Indian corn, but the Chick-Pea (*Cicer arietinum*) and the Soy Bean (*Glycine* sp.) have only been found in grain from Argentina.

The Canadian grain was generally noteworthy for containing fair amounts of wheat, barley, and flax, as the only "cultivated" representatives, although sunflower and buckwheat are apparently to be expected.

The Russian, German, and Turkish grain, as well as including wheat and barley, usually contained greater quantities of vetches than met with elsewhere; while Millet (*Panicum miliaceum*) has, so far, only been seen in these samples. Hemp would seem to be diagnostic of Russian; Serradella of German; and an unidentified legume of Turkish origin. Peas may be expected in Russian and German samples, and field beans in German.

The British samples probably contain wheat less frequently than the foreign, but often contain barley in considerable amount, the six-rowed barleys being probably more suggestive of Scotch than English or Welsh oats. Certain Scotch and some Welsh oats also frequently contain *Avena strigosa* (which has not been seen in the foreign samples examined). Vetches (cultivated) are not very common in British samples; whilst linseed, buckwheat, etc., have not once been met with; but the presence of linseed in particular could not be taken as proof of foreign origin.

(*c*) SEEDS OF WEEDS.—The results of the examination of samples for weed seeds are set out in full in Table III. In order both to contrast the distributions of the seeds met with in the samples under review with those obtained by Saunders[1], and to add greater accuracy to the conclusions to be drawn, reference is freely made in the table to that author's paper. Suitable signs are, however, used to differentiate between the results obtained on the present occasion, and those which are directly due to Saunders or to the authorities he quotes.

TABLE III.

Showing distribution of Weed Seeds contained in samples of Oats from various Countries. The figures denote the number of occurrences per ten samples examined, calculated to the nearest whole number.

SPECIES.	Russia.	Germany.	Argentina.	Chile.	U.S.A.	Canada.	New Zealand.	Great Britain.	Turkey.
Corn Crowfoot (*Ranunculus arvensis*) ..	—	—	—	—	—	—	—	p	—
Corn Poppy (*Papaver Rhœas*)	—	—	—	2	—	—	—	p	—
Tumble Mustard (*Sisymbrium altissimum*)	—	—	—	—	§	†	—	—	—
Treacle Mustard (*Erysimum cheiranthoides*	—	—	—	—	—	†	—	—	—
Hare's Ear Mustard (*Conringia orientalis*)	*	—	—	—	§	2†	—	—	—
False Flax (*Camelina sativa*)	1	—	—	—	—	4†	—	—	—
Charlock (*Brassica Sinapistrum*)	2	4	VII.	X.	IX.	VI.	p	a	p
Bird Rape (*Brassica campestris*)	1	2	*	—	*	1	—	—	—
White Mustard (*Brassica alba*)	*	—	—	—	—	—	—	—	—
Black Mustard (*Brassica nigra*)	—	—	—	2	2	—	—	—	—
Indian Mustard (*Brassica juncea*) ..	—	—	—	—	§	—	—	—	—
Wild Peppergrass (*Lepidium Virginicum*)	—	—	—	—	3	—	—	—	—
Peppergrass (*Lepidium apetalum*) ..	—	—	—	—	2	—	—	—	—
Field Peppergrass (*Lepidium campestre*) ..	*	—	—	—	*	3	—	—	—
Penny Cress (*Thlaspi arvense*)	1	—	—	—	§	2†	—	p	—
Ball Mustard (*Neslia paniculata*)	3	2	—	—	*	10†	—	—	—
Wild Radish (*Raphanus Raphanistrum*) ..	3	IX.	4	9	—	‡	—	p	—
Rapistrum rugosum	—	2	—	—	—	—	—	—	a
Cow Cockle (*Saponaria Vaccaria*) ..	*	2	—	4	*	*	—	—	—
Corn Cockle (*Lychnis Githago*)	IX.	6	4	6	3	2	—	p	p
Chickweed (*Stellaria media*)	*	—	*	—	*	*	—	p	—
Mouse Ear Chickweed (*Cerastium* sp.) ..	1	—	—	—	—	—	—	—	—
Spurrey (*Spergula arvensis*)	3	2	—	—	—	‡	—	p	—
Trefoil (*Medicago lupulina*)	*	3	2	—	—	—	—	p	—
Unidentified (*Medicago* sp.)	—	—	5	6	—	—	—	—	p
Sweet Clovers (*Melilotus alba et* sp.) ..	2	2	4	2	§	—	—	—	a
Wild Vetch (*Vicja angustifolia*)	VII.	3	—	—	—	‡	—	—	—
Hairy Tare (*Vicia hirsuta*)	VI.	3	*	3	—	—	—	p	—
Tufted Vetch (*Vicia Cracca*)	2	—	—	—	—	1	—	p	—
Hedge Vetch (*Vicia sepium*)	?	—	—	—	—	—	—	—	—
Unidentified (*Vicia* sp.)	1	—	—	—	—	—	—	—	p
Meadow Vetchling (*Lathyrus pratensis*) ..	1	—	—	—	—	—	—	p	—
Hairy Vetchling (*Lathyrus hirsutus*) ..	?	—	—	—	—	—	—	—	—
Kidney Vetch (*Anthyllis vulneraria*) ..	—	—	—	—	*	—	—	—	—
Prairie Rose (*Rosa pratincola*)	—	—	—	—	4	4	—	—	—
Wild Carrot (*Daucus Carota*)	—	—	2	—	—	—	—	p	—
Unidentified (*an Umbellifer*)	—	—	3	2	—	—	—	—	—
Unidentified (*another Umbellifer*)	—	—	—	—	—	1	—	—	—
Symphoricarpos occidentalis	—	—	—	—	—	†	—	—	—
Cleavers (*Galium Aparine*)	1	2	—	—	—	—	—	p	—
Unidentified (*Galium* sp.)	—	—	—	—	—	—	—	—	p
Field Scabious (*Scabiosa arvensis*) ..	1	1	—	—	—	—	—	p	—
May Weed (*Anthemis Cotula*)	—	—	3	—	§	—	—	p	—
Scentless May Weed (*Matricaria inodora*)	1	—	—	—	—	—	—	p	—
Creeping Thistle (*Cnicus arvensis*) ..	*	1	—	—	—	2	—	p	—
Cornflower (*Centaurea Cyanus*)	4	V.	—	—	—	—	—	p	—
Yellow Star Thistle (*Centaurea solstitialis*)	—	—	2	4	§	—	—	—	—
Chicory (*Cichorium Intybus*)	1	—	—	—	—	—	—	—	—
Great Ragweed (*Ambrosia trifida*) ..	—	—	—	—	—	4†	—	—	—
Corn Marigold (*Chrysanthemum segetum*)	—	—	—	—	—	—	—	p	p
Prairie Sunflower (*Helianthus Maximiliani*)	—	—	—	—	—	4†	—	—	—
Milk Thistle (*Silybum Marianum*) ..	—	—	4	1	—	—	—	—	—
Hound's Tongue (*Cynoglossum officinale*)	—	—	—	2	—	—	—	—	—
Corn Bindweed (*Convolvulus arvensis*) ..	VIII	3	4	—	3	4	—	p	—
Blue Bur (*Lappula echinata*)	2	—	—	—	*	5	—	—	—
Viper's Bugloss (*Echium vulgare*) ..	—	2	2	—	—	—	—	—	—
Corn Gromwell (*Lithospermum arvense*) ..	1	1	1	—	—	—	—	p	—
Field Alkanet (*Lycopsis arvensis*) ..	2	1	—	—	—	—	—	—	—
American Dragon Head (*Dracocephalum parviflorum*)	—	—	—	—	—	*	—	—	—
Hemp Nettle (*Galeopsis Tetrahit*) ..	3	2	—	—	—	‡	—	p	—
Red Hemp Nettle (*Galeopsis Ladanum*) ..	*	—	—	—	—	—	—	—	—
White Vervian (*Verbena urticifolia*) ..	—	—	—	—	§	—	—	—	—
Unidentified (*Verbena sp.*)	—	—	*	—	—	—	—	—	—
Ribgrass (*Plantago lanceolata*)	—	2	—	2	*	2	—	p	—

SPECIES.	Russia.	Germany.	Argentina.	Chile.	U.S.A.	Canada.	New Zealand.	Great Britain.	Turkey.
Great Plantain (*Plantago major*)	—	—	—	—	§	—	—	—	—
Fat Hen (*Chenopodium album et* sp.) ..	*	2	2	—	2	6	p	p	—
Orach (*Atriplex* sp.)	1	—	—	—	—	—	—	—	—
Knawel (*Scleranthus annuus*)	*3*	1	—	—	—	—	—	—	—
Russian Pigweed (*Axyris amaranthoides*)	3	—	—	—	—	‡†	—	—	—
Curled Dock (*Rumex crispus*)	1	—	2	1	1	*	p	p	—
Sheep Sorrel (*Rumex Acetosella*)	1	*	*	*4*	§	*	—	p	—
Black Bindweed (*Polygonum Convolvulus*)	VI.	VI.	6	2	9	VI.	a	a	—
Redshank (*Polygonum Persicaria*) ..	—	2	—	2	§	—	—	p	—
Pale Persicaria (*Polygonum lapathifolium*).	*4*	6	—	—	3	—	—	—	—
Glandular Persicaria (*Polygonum pennsylvanicum*)	—	—	—	—	2	—	—	—	—
Water Pepper (*Polygonum Hydropiper*) ..	—	—	—	—	§	—	—	—	—
Sun Spurge (*Euphorbia Helioscopia*) ..	—	—	—	—	—	‡	—	—	—
Unidentified (*Euphorbia* sp.)	2	—	—	—	—	—	—	—	—
Green Foxtail (*Setaria viridis*)	—	—	—	—	*	*	—	—	—
Yellow Foxtail (*Setaria glauca*)	*5*	2	—	—	6	—	—	—	—
Darnel (*Lolium temulentum*)	2	2	*4*	X.	§	*	—	p	a
Perennial Rye Grass (*Lolium perenne*) ..	—	—	*	2	—	—	—	—	—
Rye Brome Grass or Cheat (*Bromus secalinus et* sp.)	*	—	—	—	§	—	—	p	—
Old-witch Grass (*Panicum capillare*) ..	—	—	*	—	*	—	—	—	—
Timothy (*Phleum pratense*)	—	—	*	—	*	—	—	—	—
Wild Oat (*Avena fatua*)	*	2	5	2	§	*	p	p	—
Tickle grass (*Hordeum jubatum*)	—	—	—	—	—	†	—	—	—
Unidentified (*Phalaris* sp.)	—	—	*	—	—	—	—	—	—

Roman Figures indicate abundant in samples. Italics indicate moderately plentiful in samples. Ordinary Type indicates present in small amount only.

Lists have been made of weed seeds found in oats from Scotland, England, and Wales, but no record has been kept of the number of samples examined; the number of Turkish and New Zealand samples has not been sufficient to give a fair numerical statement; against the weeds from these countries the following signs are used:—

a = often abundant. p = frequently present in small amount.

* These species have been recorded by Saunders, but have not been found in the present samples.

† These species are given by Mr. A. Eastham, Chief Seed Analyst of the Canadian Department of Agriculture, as chiefly occurring in Western Canadian samples; and

‡ These species chiefly in Eastern Canadian samples.

§ The Bureau of Plant Industry of the United States Department of Agriculture records these species as common in grain samples from the States.

From the above evidence it would appear that the following distinctions can be drawn between the weeds commonly found in samples from the several countries.

Russia and Germany.—These samples are, in the main, characterised by a very similar assemblage of weed seeds. There are, however, useful differences in degree.

The Russian samples usually contain a greater number of species than grain from any other country. Very constant in the Russian oats is the large amount of Corn Cockle and of Wild Vetches (*Vicia angustifolia* and *V. hirsuta* are the most abundant). *V. Cracca* and *Lathyrus pratensis* are also met with and probably *V. sepium* and *L. hirsutus* as well. Corn Bindweed (*Convolvulus arvensis*), although occurring in samples from most countries, is more ubiquitous and abundant in Russian than in other oats. Cleavers, Field Scabious, Cornflower, Hemp Nettle and Wild Radish* (when most of the seeds are contained in the lomentum) and Field Alkanet (*Lycopsis arvensis*) are all

* These are, of course, not infrequent impurities in British samples.

suggestive of Russian or German origin and are useful guides in conjunction with the presence or absence of other species.

The German samples usually contain much less Corn Cockle, and fewer species of vetches and their allies, than the Russian, but considerably more Wild Radish, which is frequently the most abundant weed seed.

It is noteworthy that an unidentified Spurge (*Euphorbia* sp.) has so far only been found in Russian samples, and that Knawel (*Scleranthus annuus*), seen only in Russian and German samples, is considerably more plentiful in the Russian. Yellow Foxtail (*Setaria glauca*), although found in samples from other countries, is more plentiful in Russian than in German oats.

Ball Mustard (*Neslia paniculata*) is found in both Russian and German grain, but is far more prevalent in Russian samples, and in these it may be associated with Blue Bur (*Lappula echinata*), which latter plant appears to be absent from German samples. *Rapistrum rugosum* has been found in German, but not in Russian samples.

No South German oats were obtained for this investigation. Saunders, however, draws the following distinctions: "Oats from North-East Germany exhibit practically the same impurities as the Russian, but are generally better cleaned." This is in accord with results from the present samples. The cultivated Serradella has, however, been found in North-East German grain, but not in Russian. He adds: "In samples from North Central Germany *Raphanus Raphanistrum* (Wild Radish) and *Centaurea Cyanus* (Cornflower) are especially abundant." This, too, is borne out by the present investigation, "whilst in South German oats *Centaurea* (Cornflower) is uncommon and *Galium* (Cleavers) is frequent."

Turkey.—These samples, like the Russian and German oats, appear to contain a number of vetches; but some are apparently different species from those met with in Russian and German samples.

The Turkish samples are intermediate between the South American and European, for they contain an unidentified *Medicago* only found in Chilian and Argentine samples. They also contain more Darnel (*Lolium temulentum*) than has been met with in grain from any other country except Chile, and a considerable excess of Sweet Clovers (*Melilotus* sp.).

The most characteristic feature, however, appears to be the abundance of *Rapistrum rugosum*.

Canada and United States.—The Canadian weed impurities are similar in some respects to the Russian; both Ball Mustard

(*Neslia paniculata*) and Blue Bur (*Lappula echinata*) are, however, far more plentiful in the Canadian, whilst Wild Vetches are most abundant in the Russian samples. False Flax (*Camelina sativa*), Field Peppergrass (*Lepidium campestre*), Penny Cress (*Thlaspi arvense*), Fat Hen (*Chenopodium* sp.), and Hare's Ear Mustard (*Conringia orientalis*) are more plentiful in the Canadian samples. The United States and Canadian oats have a rather similar assemblage of weed seeds. The Prairie Rose (*Rosa pratincola*) appears to occur only in samples from these countries, whilst the Great Ragweed (*Ambrosia trifida*) and Prairie Sunflower (*Helianthus Maximiliani*) have been found only in Canadian grain. United States samples may apparently contain Ball Mustard (*Neslia paniculata*) and Blue Bur (*Lappula echinata*), but both are far more frequent and abundant in Canadian samples. Yellow Foxtail (*Setaria glauca*) in any quantity is a more certain index of United States origin.

The United States samples are also characterised by large amounts of *Brassica* sp. The presence of the Pepper Grasses (*Lepidium apetalum* and *L. Virginicum*), and of the Glandular Persicaria (*Polygonum pennsylvanicum*), are also useful indications of probable United States origin.

Great Britain and New Zealand.—Black Bindweed (*Polygonum Convolvulus*), which also occurs in samples from every other country (except Turkey), is frequently the only abundant weed seed in these samples. Charlock is also abundant in many samples. The New Zealand samples were so clean that little can be said about the weed seeds.

The British samples are more readily identified by the absence of such seeds as Ball Mustard (*Neslia paniculata*), Sweet Clovers (*Melilotus* sp.), Great Ragweed (*Ambrosia trifida*), and Yellow Foxtail (*Setaria glauca*), etc., than by the presence of any diagnostic species; although in the samples examined *Avena strigosa* and Corn Crowfoot (*Ranunculus arvensis*) have been found only in certain cases.

Argentina and Chile.—These samples would seem to differ from those from all other countries in the frequent presence of Milk Thistle (*Silybum Marianum*), which is, however, more characteristic of grain from Argentina than of that from Chile. The Yellow Star Thistle (*Centaurea solstitialis*) has also only been found in samples from these countries, although its presence is to be expected in oats from the United States.

An unidentified *Medicago* is freely found in samples from both these countries and from Turkey. The South American samples can, however, be differentiated from the Turkish by

the absence of *Rapistrum rugosum*, and by the fact that they contain less vetches than the Turkish.

Darnel (*Lolium temulentum*) is most abundant in the Turkish samples, abundant in the Chilian oats, and very plentiful in the Argentine grain; considerably more so in samples from these three countries than from elsewhere. Sweet Clovers (*Melilotus* sp.) are most abundant in Turkish and Argentine grain, but apparently almost absent from Chilian. Wild Oat (*Avena fatua*) is more plentiful in Argentine than any other grain.

Wild Radish is plentiful in grain from Chile, but the seed is more frequently separated from the lomentum than it is in the case of the German samples. It also occurs in Argentine oats freed from the lomentum, but it is not so abundant as in Chilian samples.

Further points of difference between samples from Argentina and Chile are:—Corn Cockle is more abundant in grain from Chile; May Weed (*Anthemis Cotula*) appears to be characteristic of Argentina, and Hound's Tongue (*Cynoglossum officinale*) of Chile.

Saunders finds an unidentified *Phalaris* sp. to be peculiar to Argentine oats.

Summary and Conclusions.—(1) Since oats, to the extent of about one-third of the home-grown crop (*i.e.*, over 18,000,000 cwt.), are imported into this country from over-seas every year, and since those from certain countries (*e.g.*, New Zealand) appear always to be of relatively high quality, and since grain from, *e.g.*, Chile, Germany, the United States, and Canada, varies in comparative quality from season to season, it is most desirable to be able to assign any particular sample to its country of origin.

(2) From what has been brought forward, it would appear that a simple method of identification is to arrive at a just appreciation of the contained weed seeds. This method is, however, of no avail in the case of well-cleaned samples. Preliminary investigations are, therefore, being conducted with clovers to try and establish some definite physiological test to apply to the seeds themselves.

With regard to the contained seeds, it will be realised that the seeds of individual species can seldom alone be taken as conclusive evidence of country of origin. The assemblage as a whole, however, in conjunction with the presence or absence of certain "cultivated" seeds makes it possible to determine the origin with a tolerable degree of accuracy.

(3) The total number of species found in oat samples is considerable, being, for all the countries together, over 100. For [illegible] however, essential to rely as far

as possible upon the comparatively few species generally present in samples.

(4) Certain seeds are ubiquitous and doubtless occur in samples from every country—such are: Charlock, Black Bindweed, Corn Cockle,* and Darnel.*

(5) The seeds of comparatively few species occur abundantly in samples, *e.g.*, Charlock, Wild Radish, Sweet Clovers, Corn Bindweed, Black Bindweed, and Darnel.

(6) The following tentative diagnosis, based on the data discussed in this paper, may prove of practical use. It must, however, be pointed out that the number of samples is not sufficient to warrant absolute reliance on the various statements.

Diagnosis.—In the following statement are given, as definitely as possible, certain characteristics which, when detected in oat samples, form a guide to the country of origin. British South African, Australian, Rumanian and Netherlands samples are excepted.

A.—Samples containing fair quantities of cultivated and wild vetches, frequently with Wheat, Barley, and Millet.

(*a*) Samples usually comparatively clean, free from pieces of earth and stone. Wild Radish more abundant than Corn Cockle. Cleavers or Cornflower sometimes well represented; cultivated Serradella not infrequent. . . . *Germany.*

(*b*) Samples generally far from clean, often containing earth and earthy stones:

(1) Often containing excess of earth and comparatively large pieces of stone with considerable amounts of *Rapistrum rugosum*, and a rather large flattened and spined *Medicago*, with relative abundance of Darnel and Sweet Clovers. . . . *Turkey.*†

(2) The grain frequently clipped; earth and stone if present not in such large pieces as above. Corn Cockle usually abundant. Wild Vetches and allies usually represented by several species. Field Bindweed often abundant. Knawel (*Scleranthus annuus*) frequent, with Hemp if present probably diagnostic. . . . *Russia.*

B.—Samples usually containing fair quantities of small Cruciferous seeds and (or) of *Chenopodium* sp., and generally relatively poor in both cultivated and wild vetches. Prairie Rose sometimes present.

(*a*) Frequently containing Indian Corn and Yellow Foxtail (*Setaria glauca*) in fair quantity; the grain often clipped. . . . *United States.*

(*b*) Generally containing Wheat, Barley, and Flax, in fair quantity, with moderate excess of Ball Mustard (*Neslia paniculata*) and Blue Bur (*Lappula echinata*) frequently present, and Prairie Sunflower perhaps diagnostic. . . . *Canada.*

C.—Samples usually containing Milk Thistle (*Silybum Marianum*) and (or) Yellow Star Thistle (*Centaurea solstitialis*) with Wild Radish

* Absent from the New Zealand samples actually examined.

† It has not at present been possible to differentiate between Turkey in Asia and Turkey in Europe.

(largely shelled out of lomentum), with the same flattened *Medicago* seen in Turkish samples, but without *Rapistrum rugosum*.

(*a*) Containing fair quantities of Wheat with no (or only traces of six-rowed) Barley, more Milk Thistle and less Star Thistle, occasionally Hounds Tongue, and usually excess of Darnel. . . . *Chile.*

(*b*) Usually containing some Wheat and Barley with frequently Indian Corn and occasionally Chick Pea (*Cicer arietinum*), with more Star Thistle and less Milk Thistle, fair quantities of Wild Oat and Darnel, and of Sweet Clovers. Grain showing evidence of quick ripening. . . . *Argentina.*

D.—Samples comparatively clean, free from other "cultivated" grain or seeds, or containing either chiefly Barley, or chiefly Wheat. Black Bindweed and Charlock the most frequent and often the only weed seeds.

(*a*) Barley more frequent or more abundant than Wheat; *Avena strigosa* sometimes met with. . . . *Great Britain.*

(*b*) Wheat apparently the only "cultivated" impurity, and doubtless, in any event, more abundant than Barley. . . . *New Zealand.*

Most of the identifications of seeds in connection with this report have been made by comparisons with specimens contained in (1) the collection of "Weed Seeds commonly found in Commercial Seeds," provided by the Bureau of Plant Industry, United States Department of Agriculture, (2) the collection of "Weed Seeds," prepared by Prof. J. Percival, University College, Reading, and (3) the writer's own collection.

The lists given in the tables and elsewhere cannot, however, be taken as complete, and probably contain minor inaccuracies.

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FEEDING COCONUT CAKE ON GRASS.

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SINCE the outbreak of war the shortage of linseed and cotton cakes has caused the stock-feeder to turn his attention to feeding stuffs which were somewhat unfamiliar to him. Of these, coconut, ground-nut and palm-nut kernel cakes are by now well-known examples. Considerable information as to the use of these foods in other countries is available in text books on feeding, but it was thought advisable, before recommending their general use, to carry out as many experiments as possible, and to accumulate experience as to their effect on English live stock in the field.

Trials on the use of these cakes for various purposes were consequently instituted by the various agricultural colleges of Great Britain. The recent work at the South-Eastern Agricultural College, Wye, and at the Midland Agricultural College, has demonstrated the value of coconut cake for milk production, and results obtained by Bruce, in Scotland, with cattle feeding in winter have been published, but no information was available as to the value of coconut cake as a food suitable for beef production on aftermath or other grazing. A field-trial was, therefore, conducted on the farm belonging to the Cambridge University School of Agriculture with a view to getting evidence on this point.

The beasts used for the trial, fourteen in number, were Herefords, or of Hereford type; some were evidently well bred, while some showed slight but distinct signs of other blood. Animals of the Hereford type were chosen because it was believed that they would be more fastidious about cake than some of the other breeds. The animals, all steers, were from 18 to 22 months old when they were purchased at Shrewsbury on the 19th June, 1915. They cost 51*s.* per cwt. live-weight, or, on the average, £16 10*s.* 0*d.** each.

After their arrival on the University farm the cattle were put in a field for a week to allow them to recover from the effects of their journey and to accustom them to their new surroundings. They were then weighed, and on the 25th June the average

* They were stated to weigh, on an average, 6 cwt. 2 qr. each, and so must have been more fasted when bought than when weighed at home a week later (see Table I).

weight of the 14 steers was 6 cwt. 3 qr. 8 lb., as shown in Table I., col. 1.

TABLE I.

Feeding on Grass without Cake.

—	Weight on June 25th. (1)	Weight on July 23rd. (2)	Gain in 28 Days. (3)	Weight on Aug. 5th. (4)	Gain in 13 Days. (5)	Gain in Whole 41 Days. (6)
	c. q. lb.	c. q. lb.	lb.	c. q. lb.	lb.	lb.
Average per Head ..	6 3 8	7 0 22·5	42·5	7 1 7	12·5	55·0
Daily Average per Head	—	—	1·52	—	0·96	1·34

The steers were turned in along with other cattle to graze a 30-acre pasture, where they stopped until July 10th. They were then separated from the other cattle and moved on to the aftermath of a 21-acre meadow in which the subsequent trials were carried out. On July 23rd they were weighed again, and they now averaged 7 cwt. 0 qr. 22·5 lb., as shown in Table I., col. 2, so that the result of 15 days on the pasture and 13 days on the aftermath had yielded an average increase for each animal of 42·5 lb., or an average daily gain of 1·52 lb. The best and worst gains were 63 lb. and 14 lb., respectively, or daily gains of 2·25 lb. and 0·50 lb.

The animals did not appear to be improving much during the days following July 23rd, and although this was partly accounted for by flies bothering them, it was decided to start giving them cake. They were, therefore, re-weighed on August 5th (see Table I., col. 4). This weighing on August 5th reflected the observation made in the field very accurately. During the period of 13 days the animals had gained, on the average, only 12·5 lb., or just under 1 lb. per day. In this case individuality was even more marked. One beast increased at the rate of 2·15 lb. daily, whereas two of the cattle lost at the rate of ½ lb. daily.

On August 6th cake-feeding began. It was judged best to introduce the coconut cake gradually, so that at first the concentrated ration was made up of equal parts of coconut cake,* linseed cake and cotton cake, and an allowance of 2 lb. per head was fed daily in 14 different tubs. Care was taken to stop bullying, as far as possible, by putting the feeding tubs at considerable distances apart in the row.

Close observation showed that none of the animals cared very much for the mixture when it was first offered to them. This

* All through the trials this cake was fed dry.

seemed markedly so as regards the coconut cake. For a while, a certain amount of the whole mixture was spilt on the grass, and a little left in the tubs, but it was obvious that as much coconut cake as possible was rejected. It was noticed that the coconut cake got moist and stuck to the animal's nose, and also that it crumbled down to a powder very readily when the animal pushed the cake about in the tub. It seemed that this was caused by the cake being broken too finely, so, with the second lot of cake, fed from the 8th day, care was taken to supply this cake in bigger pieces. This proved to be a very satisfactory change, as some of the bullocks cleared up their tubs well. Very little was spilt on the grass around the tubs and the coconut cake did not stick to the nostrils as in the previous week.

On August 20th the cake-feeding was changed and the follow-daily ration allowed per head: 3 lb. of a mixture of 2 parts of coconut cake, 1 part of linseed cake and 1 part of cotton cake. This ration was fed till September 3rd, on which date the animals were weighed and their weights were as shown in Table II., col. 2.

TABLE II.

Cake Feeding, including Coconut Cake, on Grass.

—	Weight on Aug. 5th. (1)	Weight on Sept. 3rd. (2)	Gain in 29 Days. (3)	Weight on Sept. 30th. (4)	Gain in 27 Days. (5)	Weight on Oct. 26th. (6)	Gain in 26 Days. (7)	Gain in Whole 82 Days. (8)
	c. q. lb.	c. q. lb.	lb.	c. q. lb.	lb.	c. q. lb.	lb.	lb.
Average per Head.	7 1 7	7 3 17	66·0	8 1 2	41·0	9 0 0	82·0	189·0
Daily Average per Head ..	—	—	2·28	—	1·52	—	3·15	2·30

By comparing weights on September 3rd and on August 5th, the first chance is gained of observing the effect of cake feeding. For 29 days previous to the first-mentioned weighing the animals received cake in addition to the grass. For these 29 days the average increase was 66 lb., and the average daily gain 2·28 lb. The 41 days previous to the weighing of August 5th (see Table I., col 6), when the animals were on grass alone, yielded only an average daily gain of 1·34 lb. This difference confirmed observations made in the field.

It is again remarkable how great a difference individuality showed. During this period the highest gain was 84 lb. (2·90 lb. per day) and the lowest 42 lb. (1·45 lb. per day). During the whole of this period it was very interesting to note how the different animals varied in their feeding. Observation showed

that one bullock did not touch cake until September 3rd. During the whole of the period of 29 days he had only eaten grass, and the weighbridge showed he had gained 42 lb. in live weight. The average gain of his 14 companions during the same period was 68 lb. On the day, September 3rd, that this dainty beast took to emulating his companions, the cake ration was increased from 3 to 4 lb.

During the 7 days following September 3rd the bullocks were all eating freely, and cleared up their allowance, which now consisted of 4 lb. of a mixture of one-half coconut cake and one-half linseed and cotton cakes. It was, therefore, decided to push them a little further, and on the 10th they were given the following ration: 5 lb. of a mixture of 3 parts of coconut cake, 1 part of linseed cake and 1 part of cotton cake. This change, however, was not an improvement. It was found that a considerable amount of the cake mixture was spilt on the grass around the tubs and the cattle made no attempt to pick it up. It was further noticed that while on this ration the animals scoured, and also that, while feeding, the steers would search among the mixture and pick out as much linseed and cotton cake as possible before eating the coconut cake. They were on this ration for 20 days, and the above remarks, as regards health and manner of feeding, apply to the whole time. They were weighed again on 30th September. This weighing, given in Table II., col. 4, shows an average daily gain of only 1·52 lb. (see col. 5), which contrasts badly with the gain of 2·28 lb. recorded for the period shown in col. 3.

On 8th October a new ration was started, in which the proportion of coconut cake was reduced and only 4 lb. per head per day was allowed. The ration was made up in the following proportions: 4 lb. of a mixture of 3 parts of coconut cake, 3 parts of cotton cake and 2 parts of linseed cake. It was decided thus to reduce the amount, as well as to alter the composition of the mixture, because so much cake was seen to be left uneaten on the grass. This change proved altogether advantageous. The cattle improved in coat and their dung got firm. Unfortunately, it could only be continued for 19 days, when an alteration had to be made, as the supply of coconut cake had run out.*

The change of ration necessitated another weighing on 26th October, the results of which are shown in Table II. col. 6. The daily gain for this period, shown in col. 7, averages 3·15 lb. for 26 days. This is a very satisfactory result, and one

* Owing to delay in delivery of a fresh supply due to restrictions on the railway.

which bears out the observation made in the field that, on 4 lb. of a mixture made up of 3 parts of coconut cake, 3 parts of cotton cake and 2 parts of linseed cake, the animals did uncommonly well.

The most interesting item in this particular weighing was the great increase shown by the bullock that had refused cake for 29 days. His daily gain was no less than 3·84 lb. throughout the period of 26 days.

Table II., col. 8, shows the average weight put on during 82 days of cake-feeding on grass and the average daily gain during that period. This column, compared with col. 6 of Table I., shows that the cake-feeding on grass gives an increased daily gain of 0·96 lb. per head over the grass alone period—this can but be thought very satisfactory.

With the stoppage of coconut cake, the cattle commenced, on 27th October, to receive 4 lb. per head per day of a mixture consisting of equal parts of linseed and cotton cakes. This mixture, it was noticed, was more palatable, and the few particles dropped on the grass were readily and thoroughly cleared up. The animals were fed on this ration for 13 days, when the arrival of a supply of coconut cake necessitated a new weighing. The result of this is shown in Table III., col. 2, when the steers showed an average gain of 30 lb. for 14 days (see col. 3) or 2·31 lb. per day—a satisfactory return, though not showing results superior to those obtained when the animals were receiving coconut cake.

TABLE III.

Cake Feeding, without Coconut Cake, on Grass.

—	Weight on 26th October. (1)	Weight on 8th November. (2)	Gain in 13 Days. (3)
	c. q. lb.	c. q. lb.	lb.
Average per Head	9 0 0	9 1 2	30·0
Daily Average per Head	—	—	2·31

Five of the beasts were now found to be ready for the butcher, and were consequently sold, giving good results financially, and affording every satisfaction to the purchasers. These five animals averaged 7 cwt. 0 qr. 18 lb. when first weighed, costing 51*s.* per cwt., £18 6*s.* 0*d.* each, and they sold at an average price of £24 3*s.* 0*d.*, leaving a margin of £5 17*s.* 0*d.* This has to pay for 20 weeks 2 days' grazing and 347 lb. of cake.

Two of the 9 animals left were not intended for sale.

The 7 remaining animals were put on a ration of 6 lb. a day of equal parts of coconut cake, cotton cake and linseed cake, but it was soon evident that some of them were not doing well, and this the weighbridge demonstrated on 20th November; only four of the bullocks showed an increase and three had begun to go back. The grass by now (the middle of November) was evidently not good enough for "feeding." The seven were, therefore, sent to market, and three were sold for slaughter on 29th November to the same firm of butchers who had bought the five bullocks already mentioned on 8th November. The meat of the second lot was again excellent. Great trouble was taken to ascertain the opinions of the butcher's customers as to the flavour of the meat. This was found to be all that could be desired, so that in this respect the coconut cake, which the bullocks received up to the last, had had no ill effect. The four remaining beasts returned to the farm and were sold a few days later to the same firm of butchers to be "finished" before slaughter.

The following statement shows particulars of the weights and the prices of the animals sold for slaughter. The prices were quite at the top of the markets at the various dates.

TABLE IV.

Details respecting 8 Animals Sold for Slaughter.

Number of Bullock.	Date of Sale.	Weight on 25th June	Final Weight.			Price realised.	Price per 14lb. Carcass.	Proportion of Carcass to Fasted Live-Weight.
			Un-fasted*	Fasted.†	Carcass.‡			
		st.	st.	st.	st. lb.	£ s.	s. d.	Per cent.
1	8th Nov...	56·5	77·0	71.6	39 2	24 15	12 7	55
4	" ..	68·0	84·5	78.6	46 0	27 15	12 1	59
6	" ..	52·5	68·0	63.2	35 0	22 0	12 7	55
8	" ..	56·5	72·0	67.0	38 0	23 5	12 3	57
12	" ..	53·0	72·7	67.6	35 2	23 0	13 1	52
9	29th Nov.	48·0	65·5	60.9	35 6	19 0	10 9	58
10	" ..	51·0	72·0	67.0	37 6	20 15	11 10	56
11	" ..	51·0	70·5	65.6	35 12	20 5	11 4	55

* Within 48 hours of slaughter. † Estimated by deducting 7 per cent. from unfasted live-weight. ‡ From Lowe's tables.

The financial results of grazing the 14 beasts were satisfactory. They left 2*s.* 6*d.* a week each for the grass, 6*d.* a week for labour, the residual value of over 3 cwt. of cake and nearly £2 a head to pay for railway charges from Shrewsbury, profit and incidentals. It must be noticed, however, that they were bought on 19th June at 51*s.* per cwt. unfasted live-weight. In the same sale-yard on 5th June they would probably have cost 60*s.* per cwt., which would have meant an extra cost of about £3 per

bullock. The 12 bullocks sold, out of the 14 used in the trial, averaged 48·56*s.* per cwt. live-weight unfasted. The financial statement is as shown in Table V.

TABLE V.

Average weight on 25th June	6 cwt. 3 qr. 8 lb.
„ Cost per bullock at 51*s.* per cwt. ..	£16 10*s.* 0*d.**
„ weight at last weighing (7 on 8th November and 7 on 20th November)	9 cwt. 0 qr. 23 lb.
„ Price realised (12 bullocks sold) ..	£22 7*s.* 0*d.*
„ Difference	£5 17*s.* 0*d.*
Rate per cwt. realised	£2 8*s.* 7*d.*

* See footnote on p. 117.

Conclusions.—(1) These trials appear to show that coconut cake, when suitable in price, is useful, if judiciously used, for feeding to bullocks on grass; but that it is not very palatable, and so should be gradually introduced into a mixture of more pleasing foods.

(2) The writers are inclined to advise restricting the amount to 50 per cent. of the concentrated ration. They further think it should be fed with something rather binding, such as cotton cake.

(4) It is believed that without some such food as linseed cake,† which is known to be much liked by cattle, much waste would take place, as it seems that when coconut cake is fed the abundant crumb which is formed is only eaten when mixed with something very tempting, such as linseed cake dust.

(4) It is the writers' opinion that the ration to work up to is the mixture fed after 8th October, *i.e.*, a daily ration of 4 lb. of a mixture of 3 parts of coconut cake, 3 parts of cotton cake and 2 parts of linseed cake.

The writers wish to express their indebtedness to Mr. A. J. Burgess, managing bailiff on the University farm, for the great assistance he so readily gave them in carrying out these trials, and to Miss M. A. Storry for her help in compiling the tables, etc.

PROCEEDINGS IN 1915 UNDER THE TITHE, COPYHOLD, COMMONS, AND OTHER ACTS.

IT is proposed in this article to give a short summary of the proceedings of the Board in 1915 under the Tithe, Copyhold, Commons, and other series of Acts. For the sake of public economy an annual Report in the usual form in continuation of the 1914 Report (Cd. 7916) will not be separately issued in respect of 1915.

† Subsequently to these trials, cattle have repeatedly been found to eat freely a mixture of coconut cake and ground-nut cake.

Tithe Acts, 1836 to 1891.—The value of £100 tithe rent-charge for the year 1916 is £83 2*s.* 6¾*d.*, whereas its value for the year 1915 was £77 1*s.* 4¼*d.*

Tithe rent-charges amounting to £3,022 in respect of a total area of 15,[illegible]88 acres were extinguished by declarations of merger. Tithe rent-charges and extraordinary tithe amounting in all to £836, in respect of a total area of 5,828 acres, were extinguished by redemption.

The following table gives particulars of redemptions of tithe payments, and mergers of tithe rent-charge:—

Nature of tithe payment.	Applications received.	Cases completed. No.	Cases completed. Amount of annual charge.	Cases in progress on 31st Dec., 1915.
			£	
Tithe rent-charge	235	255	832	389
Corn rents payable under Local Inclosure Acts ..	6	7	20	9
Extraordinary tithe ..	4	4	4	—
London (City) Tithe Rate ..	5	3	9	7
Vicar's Rate in Halifax ..	1	1	6*s.* 10*d.*	—
Mergers of tithe rent charge	79	90	£3,022	22

Altered apportionments of tithe rent-charge and other tithe payments were as follows:—

Nature of tithe payment.	Applications received.	Cases completed.	Cases in progress on 31st Dec., 1915.
Tithe rent-charge	242	282	279
Corn rents payable under Local Inclosure Acts..	2	6	5
Extraordinary tithe	7	7	18

Four applications were received for the Board's sanction of the exchange of glebe for other land. Five exchanges were completed, and two were in progress on 31st December.

Fees amounting to £2,053 were received in respect of business under the Tithe Acts.

Copyhold Act, 1894.—The Board received 97 applications for enfranchisement, and completed 94 cases, of which 20 were voluntary and 74 were compulsory, while 48 cases remained in progress at the end of the year. The total consideration for the

completed enfranchisements comprised capital payments amounting to £5,991, and annual rent-charges amounting to £16 17*s.* 1*d.*

Seven enfranchisement rent-charges, amounting in all to £90 15*s.* 2*d.* were redeemed, and one such rent-charge was apportioned under the Copyhold Act.

Fees amounting to £279 were received in respect of business under the Copyhold Act.

Conveyancing and Law of Property Act, 1881.—One redemption of rent-charge under Section 45 was completed in the year 1915. A total of 60 redemptions in all have now been effected under this section.

Regulation of Commons under the Commons Act, 1876.—The award of the valuer in the long-standing case of Winton and Kaber Commons, Westmorland, was confirmed by the Board on 16th October. Proceedings had been initiated by the parties in 1908 for this Regulation, which is now completed, so far as the Board are concerned, but any by-laws made by the Conservators will require confirmation by a Secretary of State.

With regard to the matter of the Regulation by Provisional Order of *Uldale Common*, in the parish of Uldale, Cumberland, mentioned in the Report for 1914, a draft P.O. was framed by the Board and sealed on 30th March. A copy was deposited in the locality, and the usual notice was issued that it was the Board's intention, in case the necessary consents were received, to certify the expediency of the P.O. being confirmed by Parliament. The requisite consents were, however, not forthcoming, and in December the Board were informed that the persons interested had decided not to proceed in the matter.

The draft P.O. provided *inter alia* for the adjustment of rights as respects common of pasture, etc., and the determination of any rights and the settlement of any disputes as to boundaries and rights in the soil. It would appear, however, that several of the commoners desired the insertion in the P.O. of a clause specifically assigning to them sheep heafs, which they stated had been used by them for generations. The Board pointed out that they had no power to make the suggested amendment, and as the commoners referred to refused their consent without such amendment the proceedings were abandoned, as indicated above. Opposition was also shown in the locality in respect of the right of access to the common proposed to be conferred on the public by the draft P.O.

Seven schemes under the Commons Act, 1899, were approved by the Board in 1915, bringing the number of schemes approved

under that Act up to 118, with a total area of 4,530 acres. The list of commons so placed under regulation in 1915 is as follows:—

Common.	District Council making Scheme.	County.	Acres.
1. Bernard's Heath ..	St. Albans Town ..	Herts ..	26¼
2. Roadside wastes in Sandpit Lane, St. Albans	,, ..	,, ..	5
3. Adwalton	Drighlington Urban ..	York (West Riding).	53
4. *Commons and waste lands in the parishes of* Barcombe, Chailey *and* Newick	Chailey Rural ..	Sussex ..	590
5. St. Cuthbert, Without	Carlisle Rural.. ..	Cumberland	6
6. Wetheral	,, ...	,,	17
7. Westleton	Blything Rural ..	Suffolk ..	45

Inclosure of Common Land.—The Board issued their consent on 27th October to the inclosure or approvement by the Lords of the Manor of Barnes, in the County of Surrey, under the Law of Commons Amendment Act, 1893, of 270 square yards of *Barnes Common.*

Consent was also given to the inclosure of a certain droveway near St. Margaret's Bay, Kent, on condition that within a year from 17th December the droveway should be constructed to a width of not less than 30 feet, and that a strip of land, with a site for a seat, should be conveyed to the Parish Council as a public walk.

An application was received on 16th February for the inclosure under Section 22 of the Commons Act, 1899, of one acre of *Cefn Hirgoed Common,* situate in the parishes of Çoity Higher, Pencoed, Coychurch Higher, and St. Bride's Minor, in the County of Glamorgan. A public elementary school was required for the children of the village of Bryncethin and neighbourhood, and a site on the Common, which is over 2,600 acres in extent, was shown to be preferable to one previously chosen. The application was made by the Glamorgan County Council under the authority of the School Sites Act, 1841, as applied by the Elementary Education Act, 1870. The Board's consent was issued on 24th July.

Commonable Rights Compensation.—On 29th July the Board issued their approval under the Commonable Rights Compensation Act, 1882, to the application, for the purposes of constructing sheep folds on the said commons and of extending an existing roadway, of the sum of £150 paid by the Great Western Railway

in compensation for the extinguishment of the commonable rights in or over portions of *Cefn Gwrhyd* and *Myndd y Garth Commons*, situate in the parish of Llanguicke, in the county of Glamorgan.

Aberdare Urban District Council Act, 1915.—By Section 43 (Part VII.) of the above-mentioned Act the Urban District Council were empowered to acquire as a recreation ground the allotment known as Hirwain Common, containing about 29¼ acres, which was allotted to the Lords of the Manor of Hirwain by the Hirwain Inclosure Award, confirmed by the Inclosure Commissioners for England and Wales on 2nd December, 1869, subject to permitting the same to be at all times used for exercise and recreation by the inhabitants of Ystradfodwg and neighbourhood. This is one of the 96 recreation grounds, the soil of which had been allotted to private persons under Section 74 of the Inclosure Act, 1845: see pp. 18-19 of the Annual Report for 1913 [Cd. 7333].

Under the Inclosure Acts, 23 Orders of exchange of land and one Order of apportionment of a fee farm rent were confirmed by the Board in 1915. The Orders of exchange affected 416 acres of land, valued at £12,314, as compared with 20 Orders in 1914, affecting 186 acres, valued at £11,992. Seventeen applications for exchange and one application for the partition of certain lands and tithe rent-charges were received in 1915.

The amount of the official fees under the Inclosure Acts received during the financial year 1914-15 was £99 10*s*.

Examination of Private Bills.—Twenty-two private Bills, proposing the alteration or extension of local administrative boundaries, or the taking of common or commonable land, were deposited with the Board in respect of the Parliamentary Session of 1915, and the proposals contained therein were examined and, where necessary, made the subject of a report to Parliament.

Changes in Local Boundaries.—Notices of inquiries by county councils, county council Orders, and Local Government Board Orders, affecting local administrative boundaries, were received in 42 cases, and the changes in boundaries made were duly noted.

Proposals affecting local boundaries in Royal Charters, Orders in Council, or Provisional Orders were referred in 16 cases to the Board by the Departments concerned and duly examined. In accordance with the provisions of Section 111 of the Town Councils (Scotland) Act, 1900, certified copies of "Sheriffs' Deliverances," altering Scottish Police Burgh Boundaries were received by the Board in three cases and duly noted. Maps deposited in compliance with Confirming Orders of the Local

Government Board, or with Provisional Order Confirmation Acts, and the certified copies of "Sheriffs' Deliverances in Scotland" are transferred by the Board to the Ordnance Survey, Southampton, for record, and are there available for inspection.

Inspection of Maps and Documents.—Facilities are afforded on payment of a fee for the inspection of certain public documents deposited with the Board. Among these are included Apportionments of Tithe Rent-charge, Certificates of Redemption of Tithe Rent-charge, Corn Rents and other money payments in lieu of Tithe, Certificates of Capital Value of Extraordinary Tithe Rent-charge, Awards of Inclosure and Regulation under the Inclosure Acts, 1845 to 1899, Boundary Awards, Schemes under the Metropolitan Commons Acts, 1866 to 1898, and Orders of Division of Intermixed Lands. Copies and extracts from these documents and tracings of any maps relating thereto are also furnished to applicants at such charges as cover the cost of making them.

The number of inspection permits issued during each of the last five years, the sums paid by the public for extracts and tracings supplied by the Board, and the payments received in inspection fees in this period, have been as under:—

Year.	Number of Inspection Permits issued.	Amounts paid by the Public for Extracts and Tracings.	Amounts paid in Inspection Fees.
		£	£
1911 ..	3,059	1,688	157
1912 ..	3,310	1,593	170
1913 ..	3,477	1,690	182
1914 ..	3,065	1,262	159
1915 ..	2,017	1,414	104

These figures are exclusive of inspection made by officers of Government Departments, in respect of which no fee is charged.

The Ordnance Survey maps of Great Britain and Ireland, on the scale of one inch to the mile, and those of Great Britain on the scale of six inches to the mile, are available for inspection at this office by the public. The Ordnance Survey maps of London on the 1-2,500 scale and maps for portions of the Metropolitan area on the scale of five feet to the mile are likewise available. Facilities are also afforded for the inspection at this office, on payment of a fee, of any other of the latest maps upon the 1-2,500 scale available from the Ordnance Survey Office, Southampton, provided that four clear days' notice of intention to inspect is given. The total number of Ordnance Survey maps inspected by the public during the year was 318.

THE MANURIAL VALUE OF SEWAGE SLUDGES.

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As man became more civilised, and found it necessary to live in larger communities, it became imperative to make some provision for the disposal of large quantities of sewage without nuisance. This could hardly be done by the simple method of "dry conservancy" as practised in small villages and by the economical Chinaman. Thus, to meet the needs of large cities, the system of water carriage came into being. As, however, it has been estimated that each adult excretes yearly about 12 lb. of nitrogen, 7 lb. of phosphoric acid, and 5 lb. of potash, worth altogether normally about 10s. 6*d.* (A. D. Hall—*Fertilisers and Manures*, 1909, page 224), it will readily be seen that, while the water carriage system is more convenient, and much more cleanly in a large community, enormous quantities of valuable fertilising materials are wasted.

The difficulty of handling and utilising these materials is obvious, particularly as they are diluted by large quantities of water. On a small scale it is practicable to apply the sewage directly to the land, and, where sufficient land is obtainable, the growth of certain crops justifies this procedure.

In the case of large towns, however, it is generally impossible to obtain sufficient suitable land within reasonable distance to deal with the large volume of liquid obtained, and, in such cases, the modern method of sewage purification by means of artificial filters is adopted. Broadly speaking, the solid matters in suspension are first settled out from the sewage in tanks, with or without the aid of chemical precipitants, and the resulting liquid is further purified by land or artificial filters.

A certain amount of valuable fertilising material escapes in solution, but a large quantity still remains as sludge from the settlement tanks and "humus" (which is formed by the coagulation of colloidal and finely suspended matters) from the artificial filters. It is the use of these residues as manures which has to be considered.

The report of the Royal Commission on Sewage Disposal is not very encouraging with regard to the use of sewage sludges as manurial agents. Experiments were carried out in various parts of the country, first on root crops, and then on hay, but no useful results were obtained. In many cases

better results were obtained on unmanured lands, but throughout the various reports it was constantly stated that the season was exceptional. (See *Royal Commission, Report No. V.*, Cd. 4278, price 2*s*. 9*d*.; also *Appendix VIII.*, 1908., Cd. 4286, price 3*d*.)

The sludges used for these trials were obtained from the settling tanks with and without chemical precipitants. The sludges were also prepared differently for manurial purposes, those containing chemicals being usually pressed and dried without further treatment, and those obtained by straightforward settlement containing a considerable proportion of lime, which had been used to facilitate pressing.

The general results obtained from the Royal Commission enquiry may be briefly stated as follows :—

> The nitrogen, phosphoric acid and potash contained in sewage sludge are not as available for plant food in sludge as in ordinary artificial manures, and sludge is, therefore, not worth the approximate price of 7*s*. per ton, calculated as the value of a sludge containing 70 per cent. moisture, estimating the prices of the ingredients on the basis of sulphate of ammonia at £12 10*s*., superphosphate at £2 15*s*., and sulphate of potash at £10 per ton.
>
> Sludges containing lime gave better results than those containing iron or aluminium, probably because of the well-known fact that calcium phosphate is more readily assimilated than phosphates of iron or aluminium.
>
> It is certain that sludge acts more slowly than artificials during the first year, and that sludge is certainly of less value than the equivalent amounts of the nitrogen and phosphorus contained in the artificials. Also it is not suitable for quickly-growing crops. The practical consideration is, however, not whether the manurial constituents of artificials are, unit for unit, more valuable than those of sludge, but whether a given increase can be produced more cheaply by sewage sludge than by artificial manures.
>
> It may also be pointed out that the manurial value may be decreased by a large proportion of grit, and, further, that the question of its economic use as a manure depends, to a large extent, on the cost of carriage.

On the whole, it would appear from this report that the manurial value of sewage sludge is not very high, in spite of the potential usefulness of its constituents. It is possible that, to some extent, the poor results obtained may have been due to the fact that many of the sludges investigated were

obtained from sewage containing trade effluents. The tests would have been fairer if preliminary experiments had been carried out with sludge from purely domestic sewage, as many mineral salts have an inhibitive effect on growing plants.

Against these rather discouraging results must be put the following practical facts :—The Manchester and some other sewage works sell dried sewage sludge at a price which covers the cost of drying and powdering. Bradford sells large quantities to the intensive gardeners of Northern France, in spite of the fact that the carriage costs 16*s.* per ton ; also to Argentina and to the U.S.A., and smaller quantities to farmers in this country. Oldham has an apparatus for drying sludge and recovering grease, patented by Dr. Grossman, who is said to find a ready sale for his final product, and it is well known that many farmers and gardeners in the neighbourhood of large sewage works find it advantageous to use sludge as a manure.

It would seem, therefore, that sufficient consideration has not been given to the different kinds of sludge, and it might be of interest to mention the different origin and composition of a few, the analyses of which are as follow :—

Results expressed in Percentages and, except Moisture, calculated on Sludge dried at 100° *C.*

Town.	*Moisture.*	*Organic and Volatile Matter.*	*Mineral Matter.*	*Nitrogen.*	*Phosphoric Acid* (P_2O_5).	*(Potash)* K_2O.
Bradford. (Pressed Cake)	27·00	—	—	3·00	1·00	trace.
Oldham. (Grossman's process) ..	—	35·00	65·00	1·50	5·50	·75
Glasgow. (Globe Fertiliser) ..	22·51	43·25	56·75	1·65	1·71	—
Kingston-on-Thames. (Native Guano) ..	10·19	50·09	49·91	2·76	2·61	—
Withington. (Emscher)	—	65·1	34·9	3·4	—	—
Dublin. (Manurito)	23·06	46·79	53·21	2·51	2·64	·26
Davyhulme. (Slurry)	10—12	35—45	65—55	1.25—2.0	1.0—2.0	—
Withington. (Activated Sludge) ..	—	69·8	30·2	5·3	4·3	1—2

1. **Sludge from Sedimentation and Chemical Precipitation Processes.**—The best examples of a profitable sludge of this type are those of Bradford and Oldham. The Bradford sludge is "cracked" with sulphuric acid. This liberates the fatty acids, which are pressed out at a high temperature and sold as grease at a profit, while the residue is used for manurial purposes in this and other countries. The sulphuric acid also helps in fixing any free ammonia by forming sulphate of ammonia.

The sludge from Oldham is degreased by steam distillation according to a process patented by Dr. Grossman. It is stated that both the grease and the remaining sludge, which is dried and powdered, are readily sold.

It may be mentioned here that the degreasing of the sludge is an important point in its preparation as a manurial agent, as it is thought that it is chiefly the presence of grease which prevents the sludge from being readily assimilated by the surrounding soil.

As types of sludge obtained by precipitation, those of Glasgow and Kingston-on-Thames might be mentioned. The former, which is produced from Glasgow sewage by precipitation with lime and ferric sulphate, has a ready sale both in the form of the pressed cake and also—after artificial drying—as the "Globe Fertiliser." Mr. Melvin, the Sewage Works Manager, states that this sludge commands a ready sale at the price of 13*s*. 6*d*. per ton in bulk, at which price the cost of preparation is more than covered. The sludge obtained from Kingston-on-Thames is sold as "Native Guano," and is precipitated from sewage by means of a mixture of alumino-ferric, blood, charcoal, and clay; it is then pressed, and dried for sale. (See *Royal Commission on Sewage Disposal, Report No. V.*, 1908, p. 159.

2. **Sludge obtained from Anaerobic Fermentation Processes.**—The simplest example of an anaerobic process is that which goes on in the ordinary septic tank. One of the latest developments of this type of process is that of the Emscher tank, the first one of which in this country was erected at the Withington Sewage Works of the Manchester Corporation.

The Emscher tank consists of two parts—a settling chamber and a digesting chamber. After passing through grit chambers to remove the grosser particles, the sewage passes into the settling chamber of the tank, and the heavier particles fall through a V-shaped slot into the sludge chamber.

Here the sludge is allowed to remain and ferment anaerobically, and can be run out from time to time on to drying beds. After the fermentation the character of the sludge appears to have changed. Most of the offensive matters have been destroyed, and a residue is left of a more or less granular nature, which, under suitable weather conditions, dries readily in specially constructed draining beds without further treatment. Such a sludge is easy to handle, and is useful as a light manure.

Another type of anaerobic sludge which has a proved manurial value is that obtained at Dublin by the Dickson process (see *Journ. Soc. Chem. Ind.*, Vol. XXXIV, May, 1915).

The sludge is fermented by the addition of yeast, and a certain percentage of moisture is got rid of by this means. Further drying is carried out by means of a patent drier and the sludge is pulverised by means of a disintegrator.

This sludge is being sold as a fertiliser in two forms :

(*a*) Manurito, which is the plain dried sludge.

(*b*) Compound Manurito, which is the same material, with the addition of phosphates and kainit.

From the experience of English and Irish nurserymen and gardeners, the normal intrinsic value of these sludges is said to be not less than £2 10s. and £3 13s. 6*d*. per ton respectively.

3. **Sludge from Aerobic Fermentation Processes.**—An aerobic fermentation of sludge goes on in the ordinary percolating filters, contact beds, and in the Dibdin slate bed. The sludge which comes away in the effluent from the percolating filters and from the Dibdin slate bed is usually collected in humus tanks, while a similar material is obtained from the washing of the media of contact beds.

This " humus "—which is formed by the coagulation of finely suspended matters due to bacterial action—commands a ready sale, as it is usually comparatively free from grease, granular in character, and therefore easy to dry.

The washings from the contact beds at Manchester (known as " slurry "), when dried and powdered, are sold at a profit ; such sludge makes a good light manure, containing at least 1½ per cent. of nitrogen, and selling at a price of 25*s*. per ton.

The most recent type of aerobic fermentation is that embodied in the activated sludge process of sewage purification. The activated sludge corresponds to the " humus " of the percolating filters and is formed by the bacterial coagulation of finely suspended and colloidal matter in presence of excess of air. Instead, however, of the sludge remaining stationary on immovable media and so presenting only a small surface to the incoming sewage, this bacterially active material is kept in constant circulation with sewage and atomized air, and so the rate of purification and clarification is greatly increased.

Although with ordinary settlement the sludge contains about 95 per cent. of moisture, it has been shown by experiments carried out at Milwaukee that by settlement in a deep pipe this percentage can be reduced to 70—75, in which state the sludge is readily handled. Further drying is still a matter for invention.

That such a sludge is of value as a manure has been shown by numerous preliminary experiments both in the United States and in this country. Experiments on a large scale have not yet been carried out in England, as it has been impossible, so far, to obtain any large quantity of activated sludge.

From experiment it has been found that activated sludge from ordinary sewage contains a smaller percentage of grease than sludge obtained by other methods, and this small quantity makes so little difference to the fertilising properties that it appears hardly worth the trouble and expense of extracting it. In certain special cases, of course, sufficient grease is present to be worth recovering for its sale, *e.g.*, activated sludge obtained from sewage containing waste from Chicago stock-yards. Under these circumstances, the sludge is degreased and the residue is suitable for manurial purposes. The effect of activated sludge on the growth of plants has been tried against equivalent amounts of nitrogen in nitrate of soda, dried blood, fish meal, etc., and in every case the sludge gave better results than any of these well-known fertilisers. The percentage of nitrogen is higher than that of ordinary sludge, often reaching 6 per cent. to 7 per cent., and, what is of even greater importance, this nitrogen is readily available when mixed with soil. This is probably due to the fact that the coagulation of finely suspended and colloidal matter is much more complete than in any other process, and the sludge becomes enriched with these substances at the expense of the effluent, which flows away with very little matter in suspension. As these substances of manurial value are held back in the sludge and not carried away as usual in the effluent, it becomes obvious why the nitrogen content of activated sludge is higher than that of sludge obtained by ordinary processes. Below is given an analysis of activated sludge obtained from domestic sewage at the Withington Sewage Works of the Manchester Corporation, kindly supplied by Mr. Edward Ardern, M.Sc., Chief Chemist to the Rivers Committee of the Manchester Corporation :—

Loss on ignition =69·8 per cent.
Nitrogen = 5·5 ,,
Mineral matter =30·2 ,, containing :—
Siliceous matter (insoluble in strong acid), = 12·9 per cent.
Iron Oxide (Fe_2O_3), = 5·2 per cent.
Alumina (Al^2O_3), = 1·9 per cent.
Phosphoric acid (P_2O_5), = 4·3 per cent.
Lime, Magnesia, potash, etc. = 5·9 per cent.

This analysis is certainly on the modest side, as samples taken later showed an increase in nitrogen. The amount of phosphoric acid in activated sludge is considerably higher than that in ordinary sludge and this again adds to its fertilising value.

Estimating the nitrogen as in sulphate of ammonia and the phosphoric acid as in superphosphate the analysis value of the dried sludge on these two ingredients alone is £5 per ton, at which price the material should bear cost of carriage.

The price should, of course, also cover cost of previous drying, and if activated sludge is to have any sale as a manurial agent (as in the case of all other sludges) the way in which it is prepared for the market is of the utmost importance. The reluctance of farmers to use sewage sludge as a manure is often due to its unattractive form, and it is well known that there is need for much work to be done on the question of economical drying and disintegrating.

In nearly all cases of ordinary sludge it appears advisable to add lime, and although this may cause a certain loss of nitrogen it seems to be more than balanced by the increased facility in pressing the sludge and also by its physical effect on the soil. A sludge containing lime in fairly large quantity does not remain sticky and tend to clog the soil. On the contrary, it keeps the soil porous, and so helps in the necessary aeration. This may be due to the fact that the lime forms a lime soap with the grease of the sludge and so disintegrates it. It is also certain that the lime assists the nitrification which is carried on bacterially in the soil and prevents sourness.

It would appear, therefore, that sewage sludge, however formed, has a certain manurial value, and this value is usually increased by extracting the grease of the sludge. To render it marketable it is necessary to dry the sludge to reduce to a minimum the cost of carriage, also to powder it in order that it may be readily incorporated with the soil. The heat used in drying is helpful in killing seeds of weeds and disease germs.

It therefore remains to be discovered what is the most economical method of drying and disintegrating sludge, so that a manure is produced which will pay for its preparation, and, at the same time, return profitably to the soil a certain percentage of the essential elements of which it is deprived, to grow food for man.

Salvation Army Holdings at Boxted.

IT was announced in January that the attempt which the Salvation Army had been making to found a small holdings colony at Boxted, in Essex, had been abandoned. The scheme originated in the desire of the late Mr. George Herring to try the experiment of placing men from the towns on the land. In 1905 and 1906 Mr. Herring discussed his ideas with the late General of the Salvation Army, and decided to place at his disposal the sum of £40,000 for the purpose of the experiment, together with a further sum of £60,000 if the first experiment should prove successful. In October, 1906, the estate at Boxted, near Colchester, comprising just over 400 acres, was purchased; the cost, including purchase money and conveyancing, amounted to £17 10*s.* an acre. For the purchase of the estate Mr. Herring advanced £8,000. The land was at once entered upon and contracts were made for erecting houses, some of which were partially built when Mr. Herring died in November, 1906. His arrangements with the Salvation Army had not been embodied in any definite Trust Deed during his lifetime, but by a codicil to his will he directed his trustees to pay over the balance of the £40,000 (viz., £32,000) to the Salvation Army on certain conditions, to be used for the settlement of the estate.

Scheme of the Chancery Court.—During the 3 years following Mr. Herring's death a great deal of litigation took place between the Salvation Army and the Trustees appointed under Mr. Herring's will, which was finally brought to an end in June, 1910, by the enrolment of a scheme by order of the Court of Chancery. As this scheme determined the conditions under which the experiment at Boxted should be carried on it is important to consider its terms. The objects of the scheme were described as follows:—

> "To promote the settlement of persons who are in poor or needy circumstances or unable to make a livelihood without assistance and who are British subjects upon land in Great Britain, with a view to their supporting themselves by agriculture or other rural industries and to their ultimately acquiring their holdings in fee simple or for some other substantial estate or interest, as a permanent means of maintenance, and in general to assist indigent British subjects to become self-supporting within the limits of the British Isles by means of agriculture and other rural industries."

It was Mr. Herring's intention that the money, after being used by the Salvation Army for the colonising experiment, should

be paid to King Edward's Hospital Fund for London. The scheme accordingly provided that money expended upon settlers should, so far as practicable, be ultimately recovered from them, and that a payment equal to one-twenty-fifth of the total amount received by the Salvation Army under the will should be paid annually by the Army to the Treasurer of the Hospital Fund until the whole amount had been so paid. It was also provided that the experiment was to be brought to an end if a payment to the Hospital Fund became 3 years overdue or if the audited accounts showed that not less than £10,000 had been lost on the working of the scheme.

Settlement of the Estate.—During the 3 years and 8 months which elapsed between the purchase of the estate and the approval of the scheme by the Court, the erection of the buildings and the preparation of the land for small holdings was carried on with borrowed money. By the end of 1910 the scheme was in full operation and about 50 families were settled on the estate. As the tenants had no capital it was arranged that until they harvested their first crop each should receive an allowance of 10*s.* per week, with an addition of 1*s.* for each child. This maintenance allowance was added to the capital value of the tenant's holding on which he eventually paid rent equal to 5 per cent. of the total amount. The holdings varied between 4 and 8 acres in size, and the valuation of the holding, house, fruit, etc., together with the money advanced for maintenance, amounted to between £500 and £550. The tenants, therefore, would pay rents of about £5 an acre inclusive.

The settlers in the first instance worked under supervision. Many of them had been drawn from towns and, although in some cases they were accustomed to cultivating a small garden, most of the men had no experience of market gardening. Throughout the estate a system of intensive cultivation was followed. In addition to the usual market garden crops, the holdings had been planted with about an acre of fruit, both top and bottom fruit, and were provided with a two-sty piggery. A co-operative plan was at once established both for marketing produce and buying supplies. The tenants were not bound by any formal agreement to sell their crops through the medium of the society, but there was an understanding that they should do so. The men, having had no previous experience of co-operation, were frequently tempted to sell their produce independently, and there was evidence of an anxiety to break away from the society whenever they thought they could secure a better price by selling individually.

Disaffection of Settlers.—Many of the men proved unadaptable to country life. They were continually desiring the conditions and interests of the town. Some, who had worked satisfactorily while under supervision, proved quite unfitted to be their own masters, and neglected their holdings. In September, 1911, a committee of enquiry, appointed by the General, reported that out of the 54 tenants in occupation, only 9 had proved their capacity to make themselves successful small holders. Of the remainder, 9 were considered incapable of maintaining themselves and the prospects of 36 were considered doubtful. The Salvation Army, therefore, decided to give the 9 successful tenants the option of taking up leases of their holding, and to dismiss the 9 failures. With regard to the 36 doubtful men it was felt that a mistake had been made in placing inexperienced men in the position of tenants without adequate training. These men were, therefore, invited to enter into new agreements with the Army in accordance with which they would receive a weekly wage of 14*s*., together with a cottage, until such time as they showed themselves capable of maintaining themselves as small holders. These terms produced a storm of indignation, and 17 men definitely refused to accept them. Eviction orders were obtained against 7 of the men, who were turned out of their houses by force.

In January, 1912, the Charity Commissioners held an enquiry on the spot, lasting 5 days. The principal complaints made by the tenants were that the land was unsuitable for small holdings; that the prices realised for produce through the co-operative society were far too low; that for a considerable time there had been no expert adviser, as promised in the original prospectus; that some of the cottages, which were built of concrete blocks, let in the damp; and that the officer of the Salvation Army in charge of the Colony had given bad advice and had been too autocratic in his methods. As a result of the enquiry the Charity Commissioners came to the conclusion that no case of actual maladministration had been made out, and that as the "General" of the Salvation Army was invested by the scheme with absolute control there was no case for Government interference.

During the difficulties above described, which extended over some 12 months in all, the operations of the settlement were so disturbed that the success of the year's (1911) cropping was very much affected, and additional men removed as a consequence. In the end about 24 men were retained upon their holdings, and of this number 20 have obtained from the Trustee of the estate a lease of their holdings for 999 years. Many of these men have not been able since obtaining their leases to

pay their rent regularly, and as the rest of the estate has been farmed at a loss, owing partly, no doubt, to the way it has been sub-divided, the Salvation Army have been unable to comply with the terms of the Scheme respecting the annual payment to the Hospital Fund, and the scheme has consequently had to be wound up.

Causes of Failure.—In view of the importance of this experiment, it is interesting to analyse, as far as possible, the causes of failure. The scheme suffered very greatly by the decease of Mr. Herring. After the land had been purchased and a beginning made with the erection of the cottages, 3 years were expended in costly litigation, during which time the estate was being worked on borrowed money. The result was that the £40,000, which it was originally estimated would be necessary for carrying out the scheme, was reduced to £32,000, all of which was expended before the men were actually settled on the land. Thus there was no reserve fund to meet the failures which were inevitable in an undertaking of this kind. These factors, which very greatly influenced the success of the scheme, are peculiar to this particular project. There are, however, other conclusions of wider application to be drawn from this failure. The land, though reasonably good, was not uniformly so, or equally suitable for successful cultivation by the type of settlers; the expert advice which was provided proved to be insufficient to make up for the lack of knowledge and application of many of the settlers; and the men, being inexperienced in market gardening, were not fitted to become tenants without a considerable period of training. Moreover, the men selected proved, in many cases, quite unsuited to country life, though they could probably have been weeded out in a sufficient period of probation; the Salvation Army were obliged, under the terms of the scheme, to select men with no capital, and therefore had to provide them with maintenance allowances for the first 12 months and more, which sum, when added to the capital value of the holding and house, made the rent higher than some of the tenants were able to pay.

Agricultural Demonstrations by Women in Cornwall.

THE following notes on two demonstrations of women's work on the land have been communicated to the Board by Mr. W. Borlase, Agricultural Organiser for Cornwall:—

Reluctance to depart from settled custom is supposed to be a characteristic of the typical farmer, and in normal times there is much that is commendable about such caution born of experience.

In his "Pilgrimage of British Farming" A. D. Hall gives judicious praise to the comparative enterprise of the Cornish farmer, but though dairy work in Cornwall is ordinarily in charge of a farmer's women folk, at the present time the women are more eager to engage in the really difficult and unpleasant agricultural tasks than farmers are to employ them.

The women, somewhat nettled by this attitude towards their desire to manifest their patriotism by working on the land and safeguarding our food supply, have recently shown by means of agricultural demonstrations that they are not only willing but capable; while the novel manifestation of ability and pluck has appealed to the interest and latent sportsmanship of farmers.

"Tell them they can borrow my plough if they like," was a not infrequent remark, "for nothing in the nature of work will be done about here *that* afternoon."

Women of all classes competed—"county people," and wives and daughters of professional men, of farmers, and of farm labourers.

Demonstration at Launceston.—The pioneer demonstration in Cornwall was held at Launceston on the 9th of March, and according to Mr. W. H. Walters, Hon. Secretary of the District War Agricultural Committee, "came about through a statement made at the Board of Guardians that women could not do the work; some women wrote to the local Press and immediately accepted the challenge. . . . The success of the demonstration was remarkable, seeing that snow was falling heavily all the morning up to about noon, though the weather was beautiful afterwards."

The Launceston competitions included:—(1) *Cutting and binding wood from a hedge*; (2) *Paring and trimming of a hedge*; (3) *Wood-sawing*; and (4) *Manure-spreading*.

There were 8 competitors in Class (1), 4 in Class (2), and 10 in each of the other Classes. All the items are reported to have been popular, and "so well pleased were the spectators with the work done, that in several cases they spontaneously offered additional prizes."

The first two items are of especial local importance, for a "hedge" in the West is distinctive, and necessarily receives attention on a "clean" and satisfactory farm.

When, however, the central demonstration at Truro was projected, Mr. M. H. Holman (Board of Agriculture representative before the County Tribunal) and other farmers thought that as far as possible the items should be such as would directly affect the production of home-grown food, and hence the arrangements were considerably modified from those made at Launceston.

Demonstration at Truro.—The following statement shows the Classes and number of entries in each case at the demonstration held at Truro on the 7th April, 43 women and girls taking part.

A—Class I.—PLOUGHING: Each competitor had to complete at least six furrows. (10 entries.)

Class II.—HARROWING: Each competitor had to work with a team of horses. (22 entries.)

Class III.—MANURE SPREADING: On arable land. (27 entries.)

Class IV.—BROADCAST MANURE SOWING FROM SEEDLIPS: Each competitor had to sow one length of the field and back, filling the seedlips from the sacks. (17 entries.)

B—Class V.—HARNESSING AND DRIVING OF HORSES IN WAGONS: Each competitor took two horses from where they stood in the field—and, after harnessing them, put them to the wagon, drove "through the top gate of the field, re-entered the field through the bottom gate, drove around the field and backed the wagon between four stakes." (25 entries.)

C—Class VI.—POTATO PLANTING WITH SHOVELS: Each competitor had to plant one row of potatoes. (17 entries—12 adults and 5 children, the latter from the adjoining school, which is provided with a garden.)

Class VII.—PREPARATION OF A BED AND PLANTING A ROW OF CABBAGES. (10 entries—5 adults and 5 juniors.)

Special prizes were awarded:—

1. "For the most generally efficient Woman Farm Worker at the Demonstration."
2. "For the best Horsewoman at the Demonstration."

Root-lifting and Topping and Tailing Roots: There were 10 entries in these Classes, but the items were withdrawn owing to the advance of farming operations on the proposed demonstration fields.

Specimens of the regulation Agricultural Uniform for Women were shown, and the St. Day Band of Women Manual Workers wore their local uniforms.

The general arrangements were in charge of a special committee under the auspices of the respective District War Agricultural Committees. Tea was supplied during the afternoon at 9*d*. per head, and at the close of each demonstration a public meeting with prize distribution was held.

The expenses were met by means of a few donations and subscriptions, by gate-money (at 6*d*. per head), profit on the tea, and trade advertisements in the 1*d*. printed official programme, which was in great demand. Copies of two reprints from the January issue of the *Journal of the Board of Agriculture*, dealing with women's labour on farms, were bound up with the programme, and thus effectually put in circulation amongst interested people.

Not only were the demonstrations self-supporting, but a profit for Red Cross funds was made in each case—over £30 in one case and about £11 in the other.

Results and Summary.—An inquiry form was issued a little time ago to all farmers in the county, and in answer to one of the questions relating to labour, and whether there was a willingness to use the services of women on the land, various replies were received; some farmers answered with a fine chivalry, some with a reasoned refusal or a qualified acceptance, and others with amused contempt.

When discussing the question of women's labour some farmers refer to the few types of work which women ought not to be expected to do on the farm instead of to the many things they can well do. The demonstrations at Launceston and Truro have shown that women are willing to tackle any necessary tasks, that they are quite capable of doing most of the ordinary work, and that in case of necessity they may prove very helpful in regard to the more difficult work also.

Alderman Hawk, the Chairman of the Cornwall War Agricultural Committee, has recently publicly stated that "at both demonstrations the work done was most creditable, and astonished a number of the farmers. If any criticisms were to be passed, it would be with respect to the arrangements of some of the stewards. The women, the majority of whom claim to be but learners, were required to do what could not be expected even of skilled labourers. In the ploughing class, for example, they had to start with new ploughs, stiff with paint, to open up a straight furrow through a long field, with only a single mark to aim at."

"Harnessing horses was another branch of work where the women might have received a little more consideration. Several of the horses were between 16 and 17 hands high, and it was unreasonable to expect women of medium height to lift the heavier part of the harness clean on the horse's back." He had known "many short expert horsemen who had always found it necessary to get on to a step or block of some kind to harness all horses; no such provision was made for the women. Even the most captious critic, however, could not fail to admit that the women handled the horses splendidly."

"The potato planting also called for special comment. This was often described as a woman's job, but planting in the past had been understood to be merely placing the sets in the rows. These women not only placed the sets, but, with spade and fork, formed the necessary straight rows and completed the work of tilling in admirable fashion."

The writer also suggests certain modifications for any future demonstrations, for the conditions under which the women were asked to plough at Truro were neither ideal nor even fair, for the

horses were strange to the competitors, while some were fresh and wanted to run away with the plough. The demonstration, however, was hastily arranged, and, in spite of a few minor details that experience showed could be somewhat differently treated, amply fulfilled its purpose.

Mr. W. Hearle, one of the judges, is of opinion that "some of the work was very well done indeed. The dung-spreading and planting were excellent, and the way in which several of the competitors handled the horses in the harrowing and in the wagons was a surprise to many of the spectators. . . . I should like to see some of the men who have been cheaply sneering at the ploughing have a try themselves. . . . However, the heavy work on a farm must be done by men, but there is a lot of work that women can do very well."

Another local farmer, who was also a judge, thinks "the demonstration will make it fashionable for women to work on the land, as previously there seemed to be a tendency of disfavour to the work. It also proved the necessity of having a leading skilled man on the farm, but women could do a lot of secondary work now done by boys."

As the demonstrations have been found to have a distinct value for propagandist and educational purposes, further demonstrations are to be held in other areas in the county, and while these will be somewhat similar to those held at Launceston and Truro, they will be arranged to suit the varying needs of the season, and will thus show that women are useful on the land at all times.

The Employment of Women on the Land.

The movement inspired by Lord Selborne, President of the Board of Agriculture and Fisheries, to induce women to do a larger share of the work on farms is making rapid progress in several counties; in others it is somewhat retarded by the apathy of farmers, by questions of wages and housing, by the dislike of a few of the old farm hands to the innovation, and the complete want of successors to the field-faring women who, a couple of generations back, milked the cows and worked on the arable land. In these counties it will need all the help that can be given by the force of example to bring the country women into the fields in sufficient numbers to save the situation.

In districts where women do little or nothing on farms, farmers find it so much easier to arrange terms with, and manage, men and boys that they are shy of approaching women with a view to employing them. That fact, quite as much as any lack of faith in the capacity of women as land workers, accounts for their

attitude of reluctance or scepticism. This passivity can be overcome by pioneer farmers employing women, taking trouble with them, and not expecting too much from them at the outset.

Enterprising farmers will be perfectly willing to pay a reasonable wage, and it is they who will fix the standard. The wage must depend on the kind of work, the season of the year, and, to some extent, on the relative capacity of the individual woman. A reasonable wage, having regard to the price of produce and the value to the employer of the work done, may be expected to attract any fit woman who realises the needs of the country and feels the burden of the rising prices owing to the scarcity of food. Too much reliance should not be placed on the efficacy of the appeal to patriotism if not accompanied by the offer of reasonable wages; at the same time it would surely be a mistake to assume that an appeal to working women to help on patriotic grounds will be lightly regarded; there is scarcely a potential working woman who has not relatives at the front or who cannot discern the relationship between the production of food at home and the increased cost of living. Thousands of working women realise that unless they step into the place of men the maximum force cannot be thrown into the fighting line to bring about a speedier termination of the war.

Women require little or no training for ordinary land work except a short course in milking. Women who, every day and most of the day, work hard with their hands at home would soon become accustomed to the use of farm tools. Something can be said for the exhilaration inspired by work in the fresh air and for the pleasure of association with other women in a common enterprise. That explains why, in some parts of the country, women prefer land work to charing within four walls.

The solution of the problem of woman labour, in substitution for the work of men, lies largely in their working together. The working of women alone in watertight compartments does not meet the case. It is not sufficient for groups of women to pick fruit and potatoes or weed carrots. The sphere of woman's work has to be enlarged. It is quite practicable to accomplish this with willingness on the part of the men on the farm to do the heavier side of the work. For example, when the man follows the corn drill and replenishes the seed box, the woman could harrow in the seed; if the man in the farmyard carries the food to the stock, the woman could help to prepare the food, feed the young stock, and milk; if the man weighs off the potatoes and loads up, the woman could riddle the potatoes; if the men horse-hoe the corn, the women could afterwards weed it; at

harvest time a man may drive the self-binder, but a woman can "stook" the barley, oats and beans, and drive the horses and wagons better and more safely than the small boy; and three men and five or six women could staff a set of threshing tackle. Co-operation of this kind has frequently been seen since the outbreak of war. Most of the men referred to would necessarily be over military age. Those who know the agricultural labourer well will agree that there is a native chivalry in his composition which may be expected to show itself in these times of difficulty and lead to that form of co-operation in work with women which is essential to secure economy in labour and the best all-round results.

This tends to show the need for village women to work on the land, *i.e.*, the women who are known to the men. When they do so work the housing question does not arise. As the small holder's wife and daughter help the small holder, so the women housed on the farm and in the village could help the farmer. There should be no insuperable difficulty in having older children properly looked after in the absence of the mother; women unable to work on the land could do this.

There are districts into which women volunteers might usefully be imported. With a quarter of a million of men gone from the rural districts there should be plenty of room to house the women. Such strangers would be welcomed at special seasons, though farmers would probably wish to test them in the first instance at work by the piece. There will be plenty of work for both classes of women in the fruit and potato-growing districts and at haytime and harvest.

It is objected that women are afraid of horses. That may be as much a question of clothing hampering freedom of movement as of nerves. With a reasonable outfit for land work and a little courage, women would find it not at all difficult to control and work the older horses on a farm, docile as they usually are.

It has been said that the war has revealed a disposition on the part of the most cautious men to try experiments of an audacious character. What, in brief, is required in districts where women have lost touch with agricultural work is a frank acceptance on the part of the farmer of the fact of their capacity to do the work and an offer of such reasonable wages as will attract them, a ready response and sustained effort on the part of such of the resident women as can leave their homes, goodwill and co-operation on the part of the men working on the farm, and a little patience and encouragement all round until the women get into their stride.

Lincolnshire Crèche to Release Women for Farm Work.

As the canvass and registration of women proceed, it becomes apparent that many women capable of working on the land and willing to do so, will be prevented unless provision is made for taking care of their children. It is not assumed that women with large families can leave their homes. There are, however, women with one or two young children who must be taken care of before a day's work on the land can be undertaken. In a large number of cases arrangements can be made with relatives or neighbours for the children to be looked after, but, even so, there remains a proportion of children the care of whom stands in the way of their mothers working in the fields.

The Holland (Lincolnshire) County War Agricultural Committee regard crèches or day nurseries as essential, and they are encouraging the establishment of them throughout the administrative county. In this county women are accustomed to work on the land and have hitherto made the best arrangements they could for the care and custody of their children. The arrangements have not always been satisfactory, as, for instance, when a woman with ten children took responsibility for the care of fourteen others gathered from cottages near by, to the detriment of the health and comfort of the children. The movement to establish day nurseries has, therefore, another side—the maintenance of the health of the children generally, and the prevention of infant mortality caused by ignorance and neglect.

The crèche at Holbeach may be taken as a good example of those in course of formation. Here the District Nursing Association are co-operating with the Women's Farm Labour Committee. The acting Medical Officer of Health is president of the Crèche Committee of local ladies. An unfurnished house has been hired for twelve months at a nominal rent. The district nurse has moved from apartments into this house and will be in charge of the arrangements, assisted by two resident probationary nursemaids obtained through the Girls' Friendly Society. The house has been furnished partly by gifts of furniture, etc., and partly from a fund of £25 collected from local farmers. The district nurse will live rent free in return for her services, and it is not expected that supervision of the crèche will materially interfere with her ordinary duties.

"Treasure" cots have been provided for twelve infants; it is proposed to accommodate thirty children in all and to give preference to infants if applications are in excess of that number. The charges provisionally fixed for taking in (and feeding)

children are 6*d.* per day for an infant up to three years old and 4*d.* per day each for a second and third child. It is not proposed to take more than three children from any one family. The mothers agree to pay these charges.

Time will show whether these apparently moderate fees will be kept up by parents on the one hand, or will be sufficient to make the scheme self-supporting on the other. In any case, the movement has an important bearing on the provision of female labour on the land, and opens up opportunities for service by committees of Urban and Rural District Nursing Associations in co-operation with the Women's Farm Labour Committees.

Notes on Feeding Stuffs in May: *From the Animal Nutrition Institute, Cambridge University.*

Prices of Feeding Stuffs.—On the whole, the fall in the prices of feeding stuffs which set in last month has continued, the most noteworthy decreases in the average prices per food unit being:— Cotton seed oil, $5\frac{1}{2}d.$; Egyptian rice meal, $4\frac{3}{4}d.$; Burmese rice meal, $4\frac{1}{4}d.$; wheat bran, $3\frac{1}{2}d.$; wheat pollards, $3\frac{1}{4}d.$; linseed oil, $2\frac{1}{2}d.$; palm-nut kernel cake, $2\frac{1}{4}d.$; and wheat bran (broad), $2\frac{1}{4}d.$ On the other hand, there have been noteworthy cases of advance in the average price per food unit, viz.:— Feeding treacle, 7*d.*; brewers' grains (wet), $3\frac{3}{4}d.$; Argentine oats, 2*d.*; English feeding barley, $1\frac{3}{4}d.$; Argentine maize, $1\frac{3}{4}d.$; and English oats, $1\frac{1}{2}d.$ Bombay cotton seed and distillery grains have been included in the tables, which are arranged exactly as last month.

Undecorticated ground-nut cake is being extensively tested on the University farm in the hope that its comparatively high content of fibre may give it something of the binding character of undecorticated cotton cake, which is still quoted at very high prices per unit. The results at present are disappointing.

Suggested Rations for May.—*Horses.*—With feeding stuffs at their present prices it behoves farmers to start feeding their horses on green stuff as soon as possible. A mixture of 8 lb. of bran and 4 lb. of crushed beans is a suitable and economical ration of dry food to use during the transition to green stuff. In feeding value it is approximately equivalent to the usual ration of a stone of oats, and, if given dry, will tend to prevent the green food from scouring the horses. As the quantity of green food is increased up to the full ration of about 1 cwt. per head per day, the allowance of the above mixture should be decreased gradually to about half a stone.

Milch Cows.—The rations suggested last month will serve until the cows have settled down to grass. At the present high price

of milk it is sound practice to feed liberally. Cows yielding not more than 2 gal. per day will not pay for additional food beyond the grass they pick for themselves. The extra food should be given to the deeper milkers, in proportion to their milk yield. Suitable and economical rations are 2 lb. of palm-nut kernel cake, or 1 lb. of ground-nut cake and 1 lb. of coconut cake, for each extra gal. of milk above 2 gal. per head per day. Cows eat

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of April.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soya Bean Cake	122·3	10	15	0	11	5	0	10	15	0	11	2	6
Decorticated Cotton Cake	126·3	13	0	0	13	0	0		—			—	
Indian Linseed Cake ..	123·1	*11	0	0	12	0	0		—			—	
English Linseed Cake ..	120·1	11	5	0	12	5	0	11	0	0	11	17	6
Bombay Cotton Cake ..	65·3	9	0	0	9	0	0	9	0	0	9	5	0
Egyptian Cotton Cake ..	71·9	9	2	6	9	10	0	10	0	0	9	15	0
Coconut Cake	102·6	9	17	6	10	10	0		—			—	
Palm-nut Kernel Cake ..	90·5	7	17	6	7	0	0	8	0	0	9	2	6
Ground-nut Cake	145·2	†10	15	0		—		10	15	0	11	10	0
English Beans	99·5	11	7	4	14	0	0	11	15	8	12	4	3
Chinese Beans	101·2	11	18	0	11	18	0		—			—	
English Maple Peas ..	97·2	12	17	9		—		14	8	10		—	
English Dun Peas ..	97·2	12	0	0		—		13	6	8		—	
Calcutta White Peas ..	97·5	18	11	1		—			—			—	
American Maize	93·8	12	2	8	12	6	5		—			—	
Argentine Maize	94·2	12	2	8	12	6	5	11	18	0	12	9	8
Maize Meal	86·5	11	10	0	13	0	0	12	17	6	12	0	0
,, Gluten Feed ..	121·6	11	2	6		—		10	10	0	12	0	0
,, Germ Meal ..	99·2	11	5	0	12	15	0	12	0	0	12	5	0
English Feeding Barley ..	83·0	14	14	0		—		14	16	10	13	3	2
English Oats	75·4	12	6	8	12	4	9	11	13	4	12	0	0
Argentine Oats	75·4	12	10	6		—			—		11	15	9
Malt Culms	69·9	7	15	0	9	0	0	6	10	0	8	0	0
Brewers' Grains (dried) ..	84·5	8	17	6		—		7	15	0	9	5	0
,, ,, (wet) ..	21·1	1	11	0		—		1	15	0		—	
Distillers' Grains (English)	101·2	9	2	6	9	0	0		—		10	5	0
,, ,, (French)	101·2	8	17	6		—			—			—	
Egyptian Rice Meal ..	78·7	10	0	0		—			—			—	
Burmese Rice Meal ..	78·7	8	10	0	8	10	0		—		10	15	0
Wheat Middlings (coarse)	93·4	9	10	0		—		9	0	0	10	15	0
,, Sharps	86·3	9	12	6	8	17	6	9	15	0	9	10	0
,, Pollards	81·9		—		7	10	0		—			—	
,, Bran	77·5	7	17	6	7	7	6	7	5	0	7	10	0
,, Bran (broad) ..	79·9	8	17	6	8	0	0	9	0	0	8	5	0
Feeding Treacle	60·0	‡12	10	0	13	5	0		—			—	
Linseed	153·5	22	0	0	§26	0	0	19	10	5	19	10	[illegible]
,, Oil	250·0	38	0	0	‖48	0	0	36	15	0	49	15	[illegible]
Egyptian Cotton Seed ..	108·6	13	2	6		—		14	2	6		—	
Bombay ,, ,, ..	99·6		—			—		13	0	0		—	
Cotton Seed Oil	250·0	43	10	0	‖55	0	0		—			—	

* Fine Calcutta (London) £11 10s. † 2nd grade (London) £10 5s.
‡ 2nd grade (London) £10 10s. § Cleaned. ‖ In barrels.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s. d.		s. d.
Brewers' grains (wet) ..	1 5½	English beans	2 3¼
Ground-nut cake ..	1 5¾	Chinese beans	2 4¼
Palm-nut kernel cake ..	1 9	Egyptian cotton seed ..	2 5
Soya bean cake	1 9	English dun peas ..	2 5¾
Distillers' grains (French)	1 9	Egyptian cotton cake ..	2 6½
Indian linseed cake ..	1 9½	Egyptian rice meal ..	2 6½
Distillers' grains (English)	1 9¾	Argentine maize ..	2 7
Maize gluten feed ..	1 10	American maize.. ..	2 7
English linseed cake ..	1 10½	English maple peas ..	2 7¾
Coconut cake	1 11	Maize meal	2 8
Wheat bran	2 0¼	Bombay cotton cake ..	2 9
Wheat middlings ..	2 0½	Linseed	2 10½
Decorticated cotton cake	2 0¾	Linseed oil	3 0½
Brewers' grains (dried) ..	2 1¼	English oats	3 3¼
Burmese rice meal ..	2 2	Argentine oats	3 3¾
Malt culms	2 2½	Cotton seed oil	3 5¾
Wheat bran (broad) ..	2 2¾	English feeding barley..	3 6¼
Wheat sharps	2 2¾	Calcutta white peas ..	3 9½
Maize germ meal ..	2 3¼	Feeding treacle	4 2

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s. d.		s. d.
Palm-nut kernel cake ..	1 6½	Maize germ meal ..	2 6¾
Distillers' grains (English)	1 9¼	Malt culms	2 7
Wheat pollards	1 10	Argentine maize	2 7½
Soya bean cake	1 10	American maize.. ..	2 7½
Wheat bran	1 10¾	Egyptian cotton cake ..	2 7¾
Indian linseed cake ..	1 11½	Bombay cotton cake ..	2 9
Wheat bran (broad) ..	2 0	English beans	2 9¾
English linseed cake ..	2 0½	Maize meal	3 0
Coconut cake	2 0½	English oats	3 3
Decorticated cotton cake	2 0¾	Linseed	3 4¾
Wheat sharps	2 0¾	Linseed oil	3 10
Burmese rice meal ..	2 2	Cotton-seed oil	4 4¾
Chinese beans	2 4¼	Feeding treacle	4 5

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s. d.		s. d.
Ground-nut cake ..	1 5¾	Maize germ meal ..	2 5
Brewers' grains (wet) ..	1 8	Argentine maize ..	2 6¼
Maize gluten feed ..	1 8¾	Linseed	2 6½
Soya bean cake	1 9	Egyptian cotton seed ..	2 7¼
Palm-nut kernel cake ..	1 9¼	Bombay cotton seed ..	2 7½
English linseed cake ..	1 10	English dun peas ..	2 9
Brewers' grains (dried) ..	1 10	Bombay cotton cake ..	2 9
Malt culms	1 10¼	Egyptian cotton cake ..	2 9½
Wheat bran	1 10½	Linseed oil	2 11¼
Wheat middlings ..	1 11	English maple peas ..	2 11¾
Wheat sharps	2 3¼	Maize meal	2 11¾
Wheat bran (broad) ..	2 3¼	English oats	3 1¼
English beans	2 4¼	English feeding barley ..	3 7

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground-nut cake	1	7	English beans	2	5½
Soya bean cake	1	10	Maize germ meal ..	2	5¾
Wheat bran	1	11¼	Linseed	2	6½
English linseed cake ..	1	11¾	Argentine maize ..	2	7¾
Maize gluten feed ..	1	11¾	Egyptian cotton cake ..	2	8½
Palm-nut kernel cake ..	2	0¼	Burmese rice meal ..	2	8¾
Distillers' grains (English)	2	0½	Maize meal	2	9¼
Wheat bran (broad) ..	2	0¾	Bombay cotton cake ..	2	10
Brewers' grains (dried) ..	2	2¼	Argentine oats	3	1½
Wheat sharps	2	2½	English feeding barley ..	3	2
Wheat middlings ..	2	3½	English oats	3	2¼
Malt culms	2	3½	Linseed oil	3	11¾

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground-nut cake ..	1	6¼	Maize germ meal ..	2	5¼
Brewers' grains (wet) ..	1	6¾	English beans	2	5¾
Distillers' grains (French)	1	9	Egyptian cotton seed ..	2	6
Palm-nut kernel cake ..	1	9¼	Egyptian rice meal ..	2	6¼
Soya bean cake	1	9½	Argentine maize ..	2	7
Wheat pollards	1	10	American maize.. ..	2	7¼
Maize gluten feed ..	1	10¼	English dun peas ..	2	7¼
Distillers' grains (English)	1	10½	Bombay cotton seed ..	2	7½
Indian linseed cake ..	1	10½	Egyptian cotton cake ..	2	8
English linseed cake ..	1	11¼	Bombay cotton cake ..	2	9¼
Wheat bran	1	11¼	English maple peas ..	2	9¾
Coconut cake	1	11¾	Linseed	2	10
Brewers' grains (dried) ..	2	0½	Maize meal	2	10¼
Decorticated cotton cake	2	0¾	Argentine oats	3	2½
Wheat middlings ..	2	1	English oats	3	2½
Wheat bran (broad) ..	2	1¾	English feeding barley ..	3	5¼
Wheat sharps	2	2¼	Linseed oil	3	5¼
Malt culms	2	2¾	Calcutta white peas ..	3	9½
Burmese rice meal ..	2	4¼	Cotton seed oil	3	11¼
Chinese beans	2	4¼	Feeding treacle	4	3½

palm-nut kernel cake readily if a little linseed cake is mixed with it for the first week or so. If the cows are on pasture which is very poor in clover, 1½ lb. of ground-nut cake may be used in place of the above.

Bullocks.—These animals will do well on grass alone if it is sufficiently plentiful. Where the grass is short it may be supplemented with linseed cake. If their dry food can be given in a shed, a mixture of linseed cake and bran is preferable to linseed cake alone, because *dry* bran is sufficiently binding to neutralise the scouring effect of young grass, but this effect is lost if the bran is fed in the open where it may get wet.

Young Stores at Grass.—At present prices, stores should be pushed on as fast as possible. The younger the animals the greater the proportion of their food they turn into increased weight. A suitable mixture for young stores at grass consists of 1 part of linseed cake, 1 part of palm-nut kernel cake, and 1 part of coconut cake; this mixture may be given at the rate of 2 to 4 lb. per head per day, according to age and size. If there is any tendency to scouring, one-third of the mixture should be replaced with bran and fed under cover so that the bran does not get wet.

Sheep.—With mutton at its present extraordinary price there is a splendid opportunity of improving grass land at a low cost

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible.				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
		Foods Rich in both Protein and Oil or Fat.				
Ground-nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English, French	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake	1 : 4·6	12·5	7·7	39·0	69·5	90
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed	1 : 6·6	11·0	16·8	30·1	77·5	102
		Fairly Rich in Protein, Rich in Oil.				
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
		Rich in Protein, Poor in Oil.				
Peas, Calcutta white	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple	1 : 3·1	17·0	1·0	50·0	70·0	92
Brewers' grains, wet	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
		Cereals, Rich in Starch, not Rich in Protein or Oil.				
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 5·3	12·0	3·0	56·0	59·1	78
Wheat sharps	1 : 5·0	12·0	4·0	50·0	58·4	77
Wheat pollards	1 : 5·3	11·6	3·5	53·0	54·1	71
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad	1 : 4·7	11·3	3·0	45·4	48·1	63

by liberal feeding of all kinds of sheep. Where mangolds are still available, they may be given to sheep on the grass with a liberal allowance of ground-nut cake. If no roots are available, ground-nut cake is too nitrogenous to use by itself. In such cases it may be mixed with palm-nut kernel cake and ground tail corn, bran, or other starchy food.

Pigs.—Barley meal is still far too expensive for pig-feeding. A mixture of sharps, pollards, or middlings with linseed cake in the proportion of about 8 to 1 is as cheap and effective as anything at present prices. The linseed cake should be ground and added to the food immediately before it is given to the pigs.

Notes on Manures in May:
From the Rothamsted Experimental Station.

BY this time most farmers should have their fertilisers safely on the farm, and most fertilisers should already be applied to the land, excepting only those for the late-sown crops like roots and potatoes, which were dealt with in last month's notes.

The only sort of dressings now likely to be wanted on the corn crops are emergency dressings, which may have to be put on in attempting to cope with insect or fungus attacks. The best fertiliser for this purpose is nitrate of soda, which causes the plant to make rapid extra growth, and may enable it to grow faster than the pest destroys it, till finally it has grown out of reach of the pest. Thus, in some places, wireworm has damaged barley or spring oats, as shown by the yellow colour of the leaf, by the hole in the stem, and still more convincingly by the discovery of the culprit itself at the root: rolling will help to retard the movements of the wireworm to new plants, and a sprinkling of nitrate of soda on the affected areas will help the plants that have hitherto escaped to grow beyond the stage at which they are liable to serious attack.

Farmers who have used certain fertilisers for the first time, or larger dressings than before, should make careful note of the effects produced, and endeavour to profit by the experience gained this season. While present prices remain farmers may reasonably hope to benefit from high manurial dressings, but less risk can be run when prices of produce become lower.

In particular, the farmer must look for causes of failure. Even the best dressing may be rendered useless if other conditions are unfavourable. When, therefore, a dressing that promised to be successful fails to give the expected return, it is essential that the reason should be discovered so that matters can be put right for another season.

The chief causes of failure are: (1) Bad soil conditions, such as want of drainage, lack of lime, or the existence of a bad tilth; (2) Insect or fungoid pests; (3) Bad weather conditions; and (4) Unsuitability of the dressing.

Land that has lain wet through the past winter, and may lie wet throughout next winter, should be marked, so that in the meantime some method may be devised for getting it drained. When this has been done lime or chalk will be wanted. Sometimes lime or chalk is all that is needed; this is particularly the case with the strong, red clays of Herts, Bucks, Surrey and Kent, which naturally are very wet and sticky, but become pervious and tractable soon after lime or chalk is added. This is work for a slack season, but unless it is noted now it is apt to be overlooked.

This is a good time for observing what land requires lime or chalk. (1) If the clover has failed to start well, or if it is patchy; (2) if the swedes, turnips or cabbage suffered from finger-and-toe; (3) if spurrey or sorrel seem to be spreading; or (4) if there was more mayweed than usual in the corn last year, it may safely be assumed that lime or chalk is wanted, and the land should be marked, so that one or other may be put on next autumn.

Insect or fungous pests, and bad weather conditions, do not come within the scope of these notes; the farmer must, however, note them in order to avoid wrongly blaming the fertiliser dressing for failure.

If none of the preceding reasons can be responsible for failure it may safely be supposed that the dressing is unsuitable either for the soil or the climatic conditions. A negative result does not prove much, but it may teach a good deal. The failure should not be allowed to pass without directing the attention of the County Advisory Officer to the matter, so that an attempt may be made to ascertain what modification may be desirable for the future.

Economy in next season's Fertiliser Bill.—It is now possible to take steps that will save some of next season's manure bill. The most costly item is nitrogen, and this, as is well known, is collected by clovers and other leguminous plants. By sowing clover or trifolium in the corn, therefore, a considerable amount of nitrogen may be fixed in the soil for next year, while an additional supply of fodder is obtained. This fact is well known, but the practice is not as common as it might be or ought to be. In view of the uncertainty of the future it is doubtless wise to spend the small amount of time and money involved now, rather than defer matters and have to buy a costly nitrogenous manure later on.

Lime and Sulphate of Ammonia.—Many farmers feel that they do not apply lime as frequently as they should, and, in consequence, have some hesitation in using sulphate of ammonia.

It is well known that sulphate of ammonia has really bad effects on land very poor in lime. This remarkable action was observed by Dr. Wheeler at the Rhode Island Experimental Station in 1890, and was investigated in an important series of experiments which showed that the trouble could be completely remedied by dressings of lime. A few years later the same phenomenon appeared on the barley plots of the Woburn Experimental Farm, and was fully described by Dr. J. A. Voelcker; there, also, lime was found to be the proper remedy. These are the two chief instances—one might almost call them classical instances—of the effect of sulphate of ammonia on soils poor in calcium carbonate.

In applying these results to agricultural practice it is necessary to observe the dates at which the harmful effects were noticed. Sulphate of ammonia has been in regular use as a fertiliser at Rothamsted since 1843, and has subsequently come into use elsewhere. It has been used at Woburn since 1876, yet it was not till the 'nineties that bad effects were seen. For the first 20 years at Woburn there was very little difference in result between sulphate of ammonia and nitrate of soda, the yields of barley per acre being:—

	Corn.		Straw.		
	Bush.	Wgt. per bush. in lb.	cwt.	qr.	lb.
Ammonium salts	33·5	51·9	18	3	17
Nitrate of soda	35·6	51·4	21	2	1

and of wheat:—

	Corn.		Straw.		
	Bush.	Wgt. per bush. in lb.	cwt.	qr.	lb.
Ammonium salts	23·8	57·3	22	1	20
Nitrate of soda	23·6	55·2	23	2	27

The dressings of ammonium salts and of nitrate of soda contained equal amounts of nitrogen. It was only later that the sulphate of ammonia began to cause marked depression of the yield.

Now, sulphate of ammonia does cause loss of lime from the soil, and here the loss has been going on unchecked for 20 years. It may be doubted whether much cultivated land is as deficient in lime as these particular plots were in 1896, when the falling off began to be noticed.

The lesson is perfectly clear; sulphate of ammonia produces these harmful results on land deficient in lime if it is used frequently and without applications of lime. There is, however, no indication that its occasional use would have any such bad effects, and farmers need not hesitate to use it at the present time. In practice it would not be used year after year on the same land, and in practice, also, the farmer who is enterprising enough to use artificial manures liberally must have learned that he needs to apply lime or chalk periodically to his land.

Unit Prices of Artificial Manures in May.—The statement on p. 156 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for May, 1916.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
Nitrogen from:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sulphate of Ammonia pure.. 95 %	16 4	16 7½	16 9½	16 9	17 6	—	17 3	17 9	—	—
Sulphate of Ammonia pure.. 93 %	—	—	—	—	—	17 5½	17 5½	—	17 4	17 2½
Calcium Cyanamide (Nitrolim)	18 0	15 9	16 4	16 1½	16 9½	—	—	—	—	17 2½
Nitrate of Soda pure 95 %	—	22 7	23 1	—	24 2½	22 7	22 9	—	22 11	—
Nitrate of Soda pure .. 90 %	23 6½	—	23 4	—	—	—	—	24 8	23 *8*	23 4
Nitrate of Lime ..	—	—	17 0	—	—	—	—	—	—	—
Castor Meal..	—	25 0	20 11½	—	—	—	—	—	—	—
Soluble Phosphates from:										
Superphosphate 35 %	2 8½	—	2 8½	3 1½	2 10½	2 9½	2 8½	2 9½	2 9½	2 9½
,, 33 %	2 8½	—	2 9½	3 2	—	2 9½	2 8½	2 9½	2 9½	2 9½
,, 30 %	2 9	—	2 10½	3 4	3 0	2 10½	2 9½	2 10½	2 10½	2 10½
,, 26 %	3 0½	2 8½	3 1	3 8	3 3	3 2	3 1	3 2	3 2	3 2
Dissolved Bones.. ..	3 9½	—	3 9	—	3 9½	4 1½	3 11½	3 10½	3 11½	3 10
Allowed for Nitrogen	*20 4½*	—	*20 4*	—	*20 6½*	*22 3*	*21 6*	*20 10½*	*21 5*	*20 9*
Allowed for Insol. Phos.	*2 4*	—	*2 4*	—	*2 4*	*2 6½*	*2 5½*	*2 4½*	*2 5*	*2 4*
Insoluble Phosphates (Citric Soluble) from:										
Basic Slag	2 6½	2 2	2 4½	—	—	—	—	—	—	—
Insoluble Phosphates from:										
Basic Slag	—	—	1 10½	—	—	—	1 8½	—	—	2 3½
Bone Meal	2 0½	2 0½	2 0½	2 1	2 2½	2 3½	2 2½	1 10½	1 11½	2 1
Allowed for Nitrogen	*17 10½*	*18 1*	*18 1*	*18 4*	*19 2*	*20 1*	*19 5½*	*16 5½*	*17 1½*	*18 2*
Steamed Bone Flour..	2 0½	1 11½	2 1	2 1½	—	—	—	1 10	—	—
Allowed for Nitrogen	*17 11½*	*16 11½*	*18 1*	*18 6*	—	—	—	*15 11*	—	—
Fish Guano..	2 8½	2 9½	1 11	—	—	—	—	—	—	—
Allowed for Nitrogen	*23 9½*	*24 4*	*16 9½*	—	—	—	—	—	—	—
Potash					No quotations.					

THE following notes have been communicated to the Board by Mr. William Law:—

Suggestions for the Destruction of Wood Pigeons.

The Wood Pigeon is one of the most destructive pests with which the farmer has to contend, and it is desirable that steps should be taken to limit its numbers. It commences to breed in April, a second nest may be formed in June, and a third in September or October. Two, or occasionally three, eggs are laid each time, and thus the wood pigeon is relatively prolific. Its numbers, at all times abundant, are augmented in autumn and winter by large flights from the Continent. In spring and summer, wood pigeons usually go in pairs; in winter they are to be seen in flocks.

Wood pigeons live largely on the grains of cereal and pulse crops, and on the leaves of clovers and turnips. They feed also on the leaves and seeds of various weeds, *e.g.*, charlock, but the harm they do is out of all proportion to the benefits they confer.

The destruction of the wood pigeon is a matter which demands both skill and cunning. Endowed with a wonderful range of vision, and a suspicious temperament, his discomfiture is by no means easy; but if he is more difficult to approach than the rook the wood pigeon forms a useful addition to the national food supply. For the latter reason it is not desirable to destroy the nests of wood pigeons, as in the case of rooks and sparrows; other means of restricting their numbers should be adopted.

In the first place, access to woods is necessary so that the birds may be shot from cover as they come home to roost. In this connection decoys, which may be either stuffed birds or wooden imitations, are often used with good effect. Wood pigeons may be decoyed nearly all the year round—in the woods, on young clover, on newly-sown corn and turnips, and on the ripening grain crops.

Shooting in Woods.—The lee side of the wood should be selected on an evening when a fairly strong wind is blowing. The decoy should be placed on a branch of a bare tree, such as an oak or an ash, before the leaves are out, so as to be easily seen by the home-coming birds. It may be necessary to climb some way up the tree, and by means of a long stick, like a fishing rod, place the decoy in as prominent a position as possible. Another decoy should be placed on the ground just outside the wood. The man with the gun should take up his position with his back to a tree, and, by means of branches, screen himself from view. His cap and coat should, as far as possible, tone with his surroundings.

Birds battling against a strong wind with their crops full of grain or green food are easily decoyed by the least sign of a mate, and will speedily come to rest. As a further inducement to alight, a few cooing notes on a dove-call may be given. An isolated tree near a wood where pigeons congregate forms a good position for a decoy. In the mating season the birds may be readily induced to approach a decoy by means of a dove-call from the wood.

Shooting on Crops.—Note should be made of where the pigeons are coming from, and the decoys placed out where they can be readily seen. The decoys should be as life-like as possible, and placed facing the wind, as wood pigeons invariably feed against the wind. Two decoys are usually carried, but as soon as the first bird is shot, it, also, should be used as a decoy. A small mound of earth should be made with a slight hollow at the top, into which the breast of the pigeon should be placed. A short twig stuck in the ground, with the other end in the lower part of the bill, may be used to support the head of the bird, and make it look as life-like as possible. The bird should face the wind, and the tail feathers should be slightly spread out. As many as twelve or eighteen birds may be thus arranged with good results, for they will then be seen from a great distance. They should be placed at distances of about 30 yards from a suitable shelter or cover erected in a ditch or against the side of a hedge or wall. In pigeon-shooting a well-designed cover is all-important, and the shelter should be so constructed as effectually to obscure the form of the watching shooter. Against a grey stone wall a couple of sacks split up and supported by sticks make a good cover. Against a hedge spruce branches may be used. The writer and a second "gun," one at one part of a field and one at the other, once killed 103 birds in a day by this means.

To prevent the birds settling in the middle of a field a few flags on short sticks may be placed at intervals up and down the field. The use of flags at the far end of a field and outwards towards the middle has the effect of carrying the birds on till they get a sight of the decoys at the other side. In this way one gun can do effective work. The best time to decoy pigeons is at break of day, when they are hungry, and again in the evening. In the heat of the day they go for water and rest.

In the destruction of wood pigeons, as of other pests, concerted action on the part of farmers and landowners over a wide area is essential. It is work of a kind which discharged or disabled soldiers might usefully undertake.

Wood pigeons usually sell at from 1*s.* to 1*s.* 4*d.* a brace, and meet a ready demand in the spring, when poultry and game are scarce.

Tring and District Sparrow Club.

THIS Club was formed early in 1914 in order to cope with the great damage which was being done by sparrows to farm and garden crops in the Tring district. The Club consists of subscribers or honorary members whose annual subscription is not less than 5*s.*, and working members who subscribe 2*s.* 6*d.* per annum for every 50 acres (or portion of 50 acres) farmed by them. Provided that the funds permit, the Club pays members at the rate of 3*d.* per dozen heads of sparrows which have been killed in the district covered by its operations, *i.e.*, within a 4-mile radius of Tring.

After two years' working the treasurer is able to state that all the local farmers agree that the numbers of sparrows have been very much reduced, and that this fact must mean the prevention of much damage to crops.

The balance sheets for the years 1914-15 and 1915-16, the period covered being from 1st February to 31st January. show that the Club has been successfully conducted financially, In 1914-15 the receipts were £21 15*s.*, consisting of 46 working members' subscriptions totalling £19 15*s.* and 7 honorary members' subscriptions amounting to £2. The expenditure included £9 13*s.* 8½*d.* paid for 9,302 sparrows' heads, and after paying other expenses there was a balance of £9 19*s.* 9½*d.* on the first year's working.

In 1915-16, 47 working members subscribed £20 2*s.* (including one 1914 subscription of 15*s.*) and 9 honorary members £1 17*s.* 6*d.*, so that the receipts, including the balance brought forward, totalled £31 19*s.* 3½*d.* The sum of £14 14*s.* 4*d.* was paid for 14,143 sparrows' heads, and the balance carried forward to the current year was £16 9*s.* 11*d.* In the two seasons' work, therefore, 23,445 sparrows were destroyed.

The foundation and rules of the Club were largely based on the suggestions given in the Board's Leaflet No. 84 (*The House-Sparrow*).

Seed Testing in North Wales.

SEEDS are tested free of charge at the University College of North Wales, Bangor, for farmers resident in the counties of Anglesey, Carnarvon, Denbigh and Flint. Samples submitted for examination should be addressed to T. J. Jenkin, B.Sc., Agricultural Department (Advisory Section), University College of North Wales, Bangor.

Seed testing work of this nature was commenced at the College in 1913, in which year 70 samples were examined; in 1914 the number dropped to 52, but efforts have been made to extend the work, and in 1915 the number of samples rose to over 300. The results of the tests communicated to farmers generally state the percentage of purity, germination, hard seeds, real value, and the chief impurities. In calculating real value, one-third of the percentage of hard seeds is assumed to be germinable, and is added to the germination percentage.

A report has recently been issued by the College on this seed-testing work, from which it would appear that the seeds bought for sowing in North Wales are of a fairly high quality, although there is still room for improvement, a good deal of loss being caused every year by the purchase of inferior seeds. In particular, the total damage caused by sowing weed seeds must be enormous: thus, while some samples of perennial rye grass showed 99·7 per cent. purity, the average was 96·1 per cent., and one sample had a purity of only 61·4 per cent.

Some of the samples showed very indifferent cleaning, and dodder was not entirely absent from the clover seeds. There was very little evidence of wilful adulteration, but a rather large proportion of yellow suckling clover seeds in some white clover samples is rather suggestive, especially in a season when white clover seeds were rather expensive. Some samples of old seeds were received, and in one case old meadow fescue seed had probably been substituted for Italian rye grass seeds.

Purity.—The following are the chief results in 1915 from the purity tests :—

	Lowest per cent.	*Average per cent.*	*Highest per cent.*
Perennial Rye Grass	61·4	96·1	99·7
Italian Rye Grass	56·4	83·3	98·5
Cocksfoot	56·7	90·8	99·2
Timothy	94·0	98·6	99·7
Meadow Fescue	98·9	99·3	99·5
Fine-leaved Fescue	92·0	97·8	99·6
Broad Red Clover	90·5	98·6	100·0
Welsh Red Clover	94·7	98·4	99·8
Cowgrass	98·5	99·6	100·0
Alsike	94·5	98·2	100·0
White or Dutch Clover	88·1	94·3	100·0
Trefoil	99·9	100·0	100·0
Oats	95·2	98·3	100·0
Swedes	100·0	100·0	100·0

Two of the samples of Italian rye grass (not included above) contained little or no Italian rye grass. The chief weed seeds, etc., were, in the grasses: Yorkshire fog, soft brome, squirrel-tail fescue, catsear, rye-like brome and sheep's sorrel; and in the leguminous plants: ribgrass, cut-leaved geranium, white campion, dock, doves-foot geranium, and yellow suckling clover.

Germination.—The following are the chief results in 1915 from the germination tests:—

	Lowest per cent.	*Average per cent.*	*Highest per cent.*
Perennial Rye Grass	54·0	82·6	95·0
Italian Rye Grass	52·0	76·0	88·0
Cocksfoot	66·0	79·9	92·0
Timothy	48·0	80·8	94·0
Meadow Fescue	92·0	94·4	98·5
Fine-leaved Fescue	48·0	60·7	70·0
Broad Red Clover	72·0	89·2	95·0
Welsh Red Clover	66·0	83·5	93·0
Cowgrass	89·0	93·4	97·5
Alsike	27·0	79·6	97·0
White or Dutch Clover	66·0	79·6	90·0
Trefoil	81·0	91·2	99·0
Oats	22·3	87·1	100·0
Swedes	78·3	88·5	94·0
Mangolds	75·0	136·0	202·0

One of the samples of broad red clover (not included above) was marked "Yearling red clover" and gave a germination of only 50 per cent.

The weights of the seeds of different germinating powers are compared throughout the report, and it is evident that the heaviest pure seeds very often have the greatest germinating capacity.

Hay Loft Sweepings.—The practice still seems to be prevalent of sowing "home-grown" seeds, or seeds collected from hay lofts, and this is strongly deprecated in the report, since these seeds cannot be satisfactorily cleaned from weeds well suited to local conditions. The following results obtained in this connection in examining six samples are striking:—

	1913–14.		1915.			
	per cent.	*per cent.*	*per cent.*	*per cent.*	*per cent.*	*per cent.*
Useful seeds	11	33·1	88·9	71·96	74·6	43·9
Weed grasses	33	24·1 }		{ 2·74	12·7 }	29·0
Other weeds	7	8·4 }	11·1	{ 5·70	1·3 }	
Chaff, dirt, etc.	49	34·4 }		{ 19·60	11·4	27·1

Seed Mixtures.—The inadvisability of the purchase of ready-made seed mixtures is urged, in view of the fact that the composition of a mixture should vary according to the special conditions under which it is to be used. Quite apart from type of soil and duration of ley, the immense importance of depth of soil, climate, and altitude above sea level is insisted on, as

these are not likely to be properly gauged by seedsmen in different parts of the country, while local seed merchants very seldom have the necessary technical knowledge to prepare a mixture to suit local conditions.

In the preparation of seed mixtures it is suggested, ***inter alia***, that (1) a smaller proportion of cocksfoot is required on wet than on dry soils; (2) that Timothy succeeds in some years, even on dry soils, in the humid North Wales climate; (3) that meadow fescue rarely, if ever, succeeds at elevations above 500 ft. above sea level; (4) that crested dogstail should be included for leys of more than two years' duration; (5) that rough-stalked meadow grass is preferable to smooth-stalked meadow grass in North Wales; (6) that meadow foxtail rarely succeeds, and should only be sown on the best land, at low elevations; (7) that "hard" and "sheep's" fescues seem to be of little use in North Wales; (8) that trefoil and kidney vetch are only really successful on limestone soils; and (9) that, of the miscellaneous plants generally recommended for permanent pastures, chicory and yarrow are the only successful ones on most soils.

Reports on the Food of the Rook, Starling and Chaffinch.

THE question of the nature of the food consumed by various species of birds has been under consideration for a number of years, with a view to ascertaining which birds are harmful and which beneficial from the agriculturist's point of view. A report by Professor Newstead on the food of a large number of species was published as Supplement No. 9 to this *Journal* in December, 1908.

In the autumn of 1908 the British Association for the Advancement of Science appointed a committee to carry out further investigations on the same subject. The birds selected for the purpose were the rook, starling and chaffinch, as to the character of which species some doubt was felt. The work of examining the birds was at first undertaken by Dr. Gordon Hewitt, and, after his appointment to the post of Entomologist to the Canadian Government, by Mr. H. S. Leigh at Manchester University. Subsequently an arrangement was made by which Mr. F. V. Theobald, who had been conducting independent enquiries into the same subject, commenced an investigation at the South-Eastern Agricultural College, Wye, similar to that already in progress. The expenses were defrayed at first by a small grant from the British Association, supplemented by additional funds from the Board, and later by a substantial grant made by the Board out of the Development Fund.

The reports of Mr. Theobald, who was assisted by Mr. W. McGowan, and of Mr. Leigh, extending in all to 56 pages, are published as a Supplement (No. 15) to the present issue of the *Journal.** The methods adopted in each investigation were on similar lines, but the work has been carried out independently. It is, therefore, interesting to note that the facts described in each report are in most respects very similar, though in one instance the conclusions drawn differ considerably. The main conclusions arrived at in each investigation are as follows:—

Wye Investigation.—*The Rook.*—This bird was found to be most harmful in devouring grain, while the part which it is supposed to play in the destruction of injurious insects was not endorsed.

The Starling was shown to be most beneficial on account of the injurious organisms destroyed—in particular the proportion of harmful mollusca was large. Only in the last three months of the year was any considerable quantity of grain eaten.

The Chaffinch.—Speaking generally, this bird was mainly insectivorous in the summer months, but appeared to eat a certain amount of grain in early spring and autumn. Large quantities of weed seeds were eaten, but practically no mollusca were found in the birds examined. The chaffinch appeared to be neutral from the economic point of view.

Manchester Investigation.—*The Rook.*—For 6 months of the year large quantities of injurious insects were eaten by rooks. The proportion of grain consumed was somewhat high during 9 months. It is emphasised, however, that the harm done is not in proportion to the amount of grain eaten, since in September and October it was frequently observed that the birds were merely taking grain dropped during harvesting operations.

The Starling.—This bird consumed large numbers of insects, the majority of which were injurious. Grain was also taken, but not in proportion to the insects, and as with the rook the damage done in this respect was not necessarily as great as the quantity of grain would suggest. It is stated that starlings, if not too abundant, must be regarded as friends of the agriculturist.

The Chaffinch.—Weed seeds were found in the greatest abundance, many instances showing that the chaffinch takes large quantities of the most troublesome weed seeds. Grain was eaten in fair quantity, but appeared to be taken chiefly from manure or ricks. The proportion of seeds of value, other than grain, was surprisingly small in view of the general impression as to the destructive habits of the chaffinch.

* Price 4*d.*, post free. Issued free to subscribers on written application.

NAMES AND ROUTES OF THE SUPER, KING'S AND BOARD'S PREMIUM STALLIONS.

Particulars of the Routes of the Stallions to which Premiums have been awarded by the Board for the Service Season 1916, together with the names and addresses of the owners of the Stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, are given below. The Routes are subject to some alteration by arrangement between the owners and the Stallion Committees.

The District Classes for England and Wales are as follow :—

District Class.	Counties.	Number of Premium Stallions.	
		King's and Super.	Board's.
1	DURHAM	—	1
	NORTHUMBERLAND	2	—
	YORK, N. RIDING	3	4
2	CUMBERLAND	1	—
	LANCASTER	1	—
	WESTMORLAND	1	—
3	YORK, E. RIDING	4	3
	,, W. RIDING	3	2
4	LINCOLN, Parts of HOLLAND	—	—
	,, ,, KESTEVEN	1	1
	,, ,, LINDSEY ..	1	1
	NOTTS	1	—
5	DERBY	1	1
	STAFFORD	1	1
6	CHESTER	—	—
	HEREFORD	1	2
	SALOP	2	1
7	ANGLESEY	—	1
	BRECKNOCK	—	—
	CARDIGAN	—	—
	CARMARTHEN	1	—
	CARNARVON	—	—
	DENBIGH	—	—
	FLINT	—	—
	GLAMORGAN	1	—
	MERIONETH	—	—
	MONMOUTH	1	—
	MONTGOMERY	1	1
	PEMBROKE	1	1*
	RADNOR	—	—

* Travels also in Cardigan.

District Class.	Counties.	Number of Premium Stallions. King's and Super.	Number of Premium Stallions. Board's.
8	Gloucester	2	1
	Oxford	—	1
	Warwick	2	1
	Worcester	1	2
9	Bedford	1	—
	Hunts	1	—
	Leicester	1	1
	Northampton	2	—
	Rutland	—	1
	Soke of Peterboro'	—	—
10	Cambs	—	—
	Isle of Ely	—	—
	Norfolk	1	2
	Suffolk	2	—
11	Bucks	2	—
	Essex	1	—
	Herts	—	1
	Middlesex	—	—
12	Kent	1	1
	Surrey	1†	—
	Sussex, East	1	1
	" West	1†	1
13	Berks	1	1
	Hants	2†	1
	Isle of Wight	—	1
14	Dorset	1	1
	Somerset	3	2
	Wilts	2	—
15	Cornwall	1	—
	Devon	2	1
	Totals	60	40

† Travels also in an adjoining county.

DISTRICT CLASS 1.

Durham, Northumberland, and York (North Riding).
5 King's Premiums and 5 Board's Premiums.

DURHAM.

Bellaggio (Board's Premium).
Owner :—Mr. C. W. Dixon-Johnson, Croft House, Croft-on-Tees, Darlington.
Route :—Bishop Auckland, Sedgefield, Stockton, Wolviston, Elwick, Trimdon, Wingate, and Ferry Hill.
Committee :—
Capt. J. E. Rogerson, Mount Oswald, Durham.
Mr. R. Ord, Sands Hall, Sedgefield, Ferry Hill.
Mr. G. Liddell, Kimblesworth Grange, Chester-le-Street, Co. Durham.

NORTHUMBERLAND.

Denis Richard (King's Premium).
Owner :—Mr. C. T. Maling, Haydon Kennels, Haydon Bridge, Northumberland.
Route :—Haydon Bridge, Wark, Barrasford, Stamfordham, Blaydon, Riding Mill, and Hexham.
Committee :—
Mr. A. M. Allgood, Walwick Grange, Humshaugh, Northumberland.
Mr. C. H. Sample, Shildon Grange, Corbridge, Northumberland.
Mr. J. O. Scott, Oaklands, Riding Mill, Northumberland.
Mr. A. C. Spraggon, Willimoteswyke Castle, Bardon Mill, Northumberland.
Mr. R. W. Warwick, Callerton Hall, Ponteland, Newcastle-on-Tyne.

Fitz Richard (King's Premium).
Owner :—Dr. A. O. Haslewood, Fairfield Stud, Buxton.
Route :—Alnwick, Howick, Doxford, Chatton, Doddington, Lowick, Ford, Cornhill, Wooler, and Alnham.
Committee :—
Mr. B. Clayhills, Estates Office, Callaley, Whittingham Northumberland.
Mr. A. Fawcus, Louth Charlton Farm, Alnwick.
Mr. J. Patten, The Park Farm, Alnwick.
Mr. G. G. Rea, Doddington, Wooler, Northumberland.

YORK (NORTH RIDING).

Jovial (King's Premium).
Owner :—Lord Middleton, Birdsall, Malton.
Route :—Birdsall, Malton, Hovingham, Gilling, Coxwold, Easingwold, Clifton, Strensall, Sheriff Hutton, and Terrington.
Committee :—
Mr. H. Hawking, Avondale, Easingwold, Yorks.
Mr. E. Parsons, Estate Office, Birdsall, Malton.
Mr. S. A. Payne-Gallwey, Brandsby Lodge, Easingwold, Yorks.

Maitre Corbeau (King's Premium).

Owners :—Capt. T. L. Wickham-Boynton and Mr. H. A. Cholmondeley, Burton Agnes Hall, Driffield.

Route :—Pickering, Salton. Normanby, Nunnington, Kirby Moorside, Snainton, and Seamer.

Committee :—

Mr. Robin Hill, The Low Hall, Brompton, Yorks

Mr. J. Peter, Duncombe Park Estate Office, Helmsley. Yorks.

Mr. H. P. Webster, Abbey Farm, Yedingham, West Heslerton, [York.

Thistledown (King's Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.

Route :—Thirsk, Pickhill, Bedale, Northallerton, Great Smeaton, Croft, and Richmond.

Committee :—

Mr. J. F. Baker-Baker, East Hall, Middleton Tyas, Yorks.

Mr. T. Clark, Winton House, Northallerton.

Mr. E. H. Courage, The Hall, Kirkby Fleetham, Bedale.

Cavour (Board's Premium).

Owners :—Messrs. T.&H. Ward, Pinchinthorpe, Guisborough, Yorks.

Route :—Thornaby-on-Tees, Yarm, Ingleby Greenhow, Hutton Rudby, Seamer, Stainton, and West Acklam.

Committee :—

Mr. T. W. Jackson, Thornaby-on-Tees, Stockton.

Mr. W. Scarth, Carlton Grange, Northallerton.

Mr. W. Thomas, Seamer Hill, Yarm, Yorks.

Courtisan II. (Board's Premium).

Owner :—Lieut.-Colonel The Earl of Feversham, Duncombe Park, Helmsley, Yorks.

Route :—Helmsley, Rievaulx, Scawton, Cold Kirby, Old Byland, Hawnby, Bilsdale, Bransdale, Farndale, Gillamoor, Fadmoor, and Pockley.

Committee :—

Mr. A. Pearson, Helmsley, Yorks.

Mr. Johnson Garbutt, Chop Gate, Stokesley, Yorks.

Mr. J. Duck, Wold House, Farndale, Kirby Moorside, Yorks.

Lord of the Valley (Board's Premium).

Owner :—Mr. J. W. Walton, Stud Farm, Guisborough, Yorks.

Route :—Guisborough, Skelton, Brotton, Loftus, Castleton, Stokesley, Ormesby, Redcar, Marske, and Saltburn.

Committee :—

Sir A. E. Pease, Bart., Pinchinthorpe, Guisborough, Yorks.

Mr. J. Hutchinson, London Joint Stock Bank, Guisborough, Yorks.

Mr. Sidney Morton, M.R.C.V.S., Wilson Street, Middlesborough.

Vellum (Board's Premium).

Owner :—Mr. J. W. Leng, Ings House, Skelton Road, York.

Route :—Ruswark, Sandsend, Lythe, Hinderwell, Lealholm Bridge, Glaisdale, Egton Bridge, Grosmont, Sleights, Smeaton Fylingdales, Staintondale, Ravenscar, Robin Hood's Bay, Hawsker, and Whitby.

Committee :—

Mr. G. Rhea, Limber Hill, Egton, Grosmont, Yorks.

Mr. J. G. Tomlinson, Central Chambers, Baxtergate, Whitby.

Mr. J. Welford, Raven Hill Farm, Dunsley, Whitby.

DISTRICT CLASS 2.

Cumberland, Lancaster, and Westmorland.
3 King's Premiums.

CUMBERLAND.

Elector (*King's Premium*).

Owner :—Mr. A. McMahon, Corbally House, Ballylinan, Queen's County, Ireland.

Route :—Aspatria, Cockermouth, Penrith, Carlisle, and Brampton.

Committee :—

Mr. F. Armstrong, George Hotel, Penrith.
Mr. G. M. Bell, Land Agent, 1, Lonsdale Street, Carlisle.
Mr. R. Edwin James, Manor House, Oughterside, Carlisle.

LANCASTER.

Soft Answer (*King's Premium*).

Lessee :—Mr. George Dickinson, Cark Mills, Cark-in-Cartmel, Lancashire.

Route :—Cark-in-Cartmel, Lindale, Flockburgh, Grange, Newton, Dalton, Ulverston, Carnforth, Lancaster, Wennington, and Hornby.

Committee :—

Mr. E. Bohane, Derby House, Preston.
Mr. G. Dickinson, Cark Mills, Cark-in-Cartmel, Lancashire.
Dr. E. S. Jackson, Robin Hill, Carnforth.

WESTMORLAND.

Tates (*King's Premium*).

Owner :—Mr. R. Rimmer, M.R.C.V.S., 52, Stramongate, Kendal.

Route :—Kendal, Appleby, Askham, Shap, Windermere, Kirkby Lonsdale, and Milnthorpe.

Committee :—

Mr. G. G. Robinson, Underley Farm, Kirkby Lonsdale.
Mr. J. Wilson, Victoria Road, Penrith.

DISTRICT CLASS 3.

York (East and West Ridings).
7 King's Premiums and 5 Board's Premiums.

YORK (EAST RIDING).

Bachelor's Lodge (Super Premium).

Owners :—Capt. T. L. Wickham-Boynton and Mr. H. A. Cholmondeley, Burton Agnes, Driffield.

Route :—Swine, Coniston, Skirlaugh, Rise, Withernwick, Aldborough, Burton Pidsea, and Hedon.

Committee :—

Mr. F. Reynard, Sunderlandwick, Driffield.
Mr. T. Robinson, Nuthill, Preston, Hull.
Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.

Berrill (King's Premium).
Owners :—Capt. T. L. Wickham-Boynton and Mr. H. A. Cholmondeley, Burton Agnes, Driffield.
Route :—Burton Agnes, Rudstone, North Burton, Hunmanby, Wold Newton, Weaverthorpe, Helperthorpe, Luton, Sledmere, and Kilham.
Committee :—
Mr. J. S. Chubb, Sledmere, Malton.
Mr. H. Holtby, Kilham, Driffield.
Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.

Birk Gill (Super Premium and Winner of the King's Champion Challenge Cup).
Owners :—Capt. T. L. Wickham-Boynton and Mr. H. A. Cholmondeley, Burton Agnes, Driffield.
Route :—Brandesburton, Beverley, Etton, Bainton, and Driffield.
Committee :—
Mr. F. Reynard, Sunderlandwick, Driffield.
Capt. J. J. Ridley, M.R.C.V.S., Osborne House, Beverley.
Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.

Crathorne (King's Premium).
Owner :—Lord Middleton, Birdsall, Malton.
Route :—Birdsall, Bossall, Stamford Bridge, Escrick, Market Weighton, and Pocklington.
Committee :—
Mr. E. Parsons, Estate Office, Birdsall, Malton.
Mr. C. W. Thompson, Red House, Escrick, York.
Lieut.-Col. The Hon. T. Willoughby, Howsham Hall, York.

Agadir (Board's Premium).
Owner :—Capt. T. L. Wickham-Boynton, Burton Agnes Hall, Driffield.
Route :—Burton Agnes, Fraisthorpe, Carnaby, Bessingby, Reighton, Muston, Flixton, Ganton, Weaverthorpe, and Heslerton.
Committee :—
Mr. J. S. Chubb, Sledmere, Malton.
Mr. J. Cranswick, The Howe, Hunmanby, Yorks.
Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.

***Pipe of Port** (Board's Premium).
Owner :—Major Clive Wilson, M.F.H., Little Tranby, Beverley.
Route :—Beverley, Nafferton, Kelk, Bewholme, Atwick, Hornsea, Tickton, and Wawne.
Committee :—
Mr. E. C. Bainton, Red House, Beverley.
Mr. J. Simons Harrison, Hurn Lodge, Beverley.
Capt. J. J. Ridley, M.R.C.V.S., Osborne House, Beverley.

San Stefano (Board's Premium).
Owner :—Capt. T. L. Wickham-Boynton, Burton Agnes Hall, Driffield.
Route :—Beverley, Walkington, Cottingham, Hessle, Cave, Newbald, and Bishop Burton.
Committee :—
Mr. E. C. Bainton, Red House, Beverley.
Mr. J. Simons Harrison, Hurn Lodge, Beverley.
Mr. F. Reynard, Sunderlandwick, Driffield.

* Hunter Stallion.

YORK (WEST RIDING).

Adeodatus (King's Premium).

Owners :—Messrs. E. & P. Hodgson, Riding Fields Stud, Beverley.
Route :—Selby, Snaith, Goole, Thorne, Doncaster, Bawtry, Monk Fryston, and Haddlesey.
Committee :—
Mr. M. Beaumont, Wood Farm, Whitley Bridge, Yorks.
Mr. W. Coulman, The Hall, Eastoft, Swinefleet, Yorks.
Mr. T. Frost, The Poplars, Bawtry, Yorks.

Forcett (King's Premium).

Owner :—Mr. John Lett, Rillington, York.
Route :—Wetherby, Harrogate, Knaresborough, Ripon, and Boroughbridge.
Committee :—
Mr. W. H. Ferrand, Duchy House, Harrogate.
Mr. B. North, 31, Market Place, Ripon.
Mr. T. Robinson, The Laurels, Wetherby.

Merry Fox (King's Premium).

Owner :—Capt. A. E. Clerk, c/o The Manager, Burton Agnes Stud, Driffield.
Route :—Acomb, Sherburn, Halton, Shadwell, Harewood, Boston Spa, Tockwith, Moor Monkton, and Poppleton.
Committee :—
Mr. R. B. Arminson, Askham Fields, York.
Mr. C. E. Cass, Springwell, Kirk Hammerton, York.
Mr. B. Day, The Rookery, Chapel Allerton, Leeds.

Ethelbruce (Board's Premium).

Owner :—Mr. T. Carr, Station Road, Selby.
Route :—Pontefract, Kellington, Whitley, Knottingley, Darrington, Womersley, Kirk Smeaton, High Melton, Barnborough, Bentley, Hickleton, South Kirkby, Hemsworth, Badsworth, and Ackworth Moor Top.
Committee :—
Dr. E. J. H. Sullivan, South Kirkby, Wakefield.
Mr. T. Dawson, M.R.C.V.S., Horsefair, Pontefract.
Mr. G. Townend, Manor House Farm, Little Smeaton, Pontefract.
Mr. John Cooke, High Melton, Doncaster.

Fairburn (Board's Premium).

Owner :—Mr. J. W. Blackburn, 63, Lickley Street, Ripon.
Route :—North Stainley, Mickley, Grewelthorpe.
Kirkby Malzeard, Pateley Bridge, Blubberhouses.
Otley, Pannal, and Hampsthwaite.
Committee :—
Mr. T. A. Hudson, Rudding House, Pannal, Harrowgate.
Mr. J. T. Verity, Pateley Bridge, Harrogate.
Mr. Pearson Watson, North Lees Grange, Ripon.

DISTRICT CLASS 4.

Lincoln (Holland, Kesteven, and Lindsey) and Notts.
3 King's Premiums and 2 Board's Premiums.

LINCOLN (KESTEVEN).

Tantamount (King's Premium).
Owner :—Lord Middleton, Birdsall, Malton.
Route :—Stoke Rochford, Barrowby, South Witham, Corby, Bourne, Rippingale, and Folkingham.
Committee :—
Mr. G. H. Mays, Brook House, Bourne.
Mr. W. Newton, Barrowby Old Hall, Grantham.
Mr. J. E. Thurman, Corby, Grantham.

King's Courier (Board's Premium).
Owner :—Mr. E. S. Tomlinson, North Rauceby, Grantham.
Route :—North Rauceby, Sleaford, Scopwick, Blankney, Harmston, Boothby, Fenton, Marston, and Ancaster.
Committee :—
Mr. P. Brown, Dorrington, Lincoln.
Mr. C. T. Marriner, Rowston Manor, Lincoln.
Mr. C. Woods, Manthorpe, Grantham.

LINCOLN (LINDSEY).

Irawaddy (King's Premium).
Owners :—Messrs. C. J. C. Hill, and E. S. Tomlinson, Glentworth Hall, Lincoln.
Route :—Glentworth, Torksey, Lincoln, Brigg, and Wootton.
Committee :—
Mr. F. A. Holmes, M.R.C.V.S., Hemswell, Lincoln.
Mr. W. B. Swallow, Wootton Lawn, Ulceby, Lincs.
Mr. H. C. Tong, Office of the County Council, Mint Street, Lincoln.

Monkey Tricks (Board's Premium).
Owners :—The Southwold Hunt Sire Association, Claythorpe Manor, Alford.
Route :—Alford, Spilsby, Louth, Brocklesby, Girsby, and Horncastle.
Committee :—
Mr. H. D. Addey, Claythorpe Manor, Alford.
Mr. E. Crowder, Thornton, Horncastle.
Mr. W. B. Swallow, Wootton Lawn, Ulceby, Lincs.

NOTTS.

Indian Runner (King's Premium).
Owner :—Lieut.-Colonel R. L. Birkin, D.S.O., Edale House, The Park, Nottingham.
Route :—Radcliffe-on-Trent, Tollerton, Bingham, Flawborough, Newark, Fledborough, Tuxford, Ollerton, and Southwell.
Committee :—
Mr. T. Ellerby, Fledborough, Newark.
Mr. F. Hardy, Staunton Hall, Nottingham.
Mr. O. Quibell, Shalem Lodge, Newark.
Mr. F. O. Thurman, Welldale, East Leake, Loughborough.

DISTRICT CLASS 5.

Derby and Stafford.

2 King's Premiums and 2 Board's Premiums.

DERBY.

Tydides (King's Premium).

Owner :—Dr. A. O. Haslewood, Fairfield Stud, Buxton.

Route :—Buxton, Bakewell, Ashbourne, Uttoxeter, Sudbury, and Derby.

Committee :—

Mr. T. H. L. Duckworth, M.R.C.V.S., Ashbourne.
Messrs. Hampson Bros., 3, The Quadrant, Buxton.
Major F. W. Peacock, Vernons Oak, Somersall Herbert, Derby.

***Dalenburg** (Board's Premium).

Owner :—Dr. A. O. Haslewood, Fairfield Stud, Buxton.

Route :—Buxton, Foolow, Bamford, Hathersage, Greenhill, Chesterfield, Ashover, Matlock Green, Wirksworth Youlgreave, and Chelmorton.

Committee :—

Rev. J. B. Nodder, Ashover Rectory, Chesterfield.
Mr. W. Tinsley, Rookery, Ashford, Bakewell.
Mr. W. Wilson, M.F.H., Horsley Gate Hall, Holmesfield, Sheffield.

STAFFORD.

St. Fagans (King's Premium).

Owners :—Messrs. J. F. Rees, and W. V Howell Thomas, 22, Lammas Street, Carmarthen.

Route :—Madeley, Newcastle, Stone, Rugeley, Lichfield, Penkridge, Stafford, Eccleshall, and Whitmore.

Committee :—

Mr. R. Carless, M.R.C.V.S., Stafford.
Mr. H. Toon, Greenhill, Norton Bridge, Stone.
Mr. R. S. Wilkinson, Swinchurch, Newcastle, Staffs.
Mr. H. J. C. Winterton, Westgate, Lichfield.
Mr. E. Woodcock, M.R.C.V.S., Eccleshall, Stafford.

Origo (*Board's Premium*).

Owner :—Dr. A. O. Haslewood, Fairfield Stud, Buxton.

Route :—Alstonfield, Waterhouses, Basford, Cheddleton, Leek, Endon, Hanley, Longton, Cheadle, and Snelston.

Committee :—

Mr. W. Bestwick, Hope, Alstonfield, Ashbourne.
Dr. Hall, Waterhouses, Ashbourne.
Mr. J. H. Hall, Leek.
Mr. P. Hammersley, Leek.

* Hunter Stallion.

DISTRICT CLASS 6.

Chester, Hereford, and Salop.
3 King's Premiums and 3 Board's Premiums.

HEREFORD.

Bacton Lad (*King's Premium*).

Owner :—Mr. F. W. Barling, Bartestree Court, Hereford.
Route :—Hereford, Ledbury, Ross, Leominster, and Bromyard.
Committee :—
Mr. J. Bird, Livers Ocle, Hereford.
Mr. C. Addison Hall, 34, Etnam Street, Leominster.
Capt. T. R. Symonds, Mynde Park, Hereford.

Nevers II. (Board's Premium).

Owner :—Mr. J. B. Dowding, Fairfield, Leominster.
Route :—Fairfield (Leominster), Bredenbury, Stoke Bliss, Brimfield, Eyton, Mortimer's Cross, Leintwardine, Nash, and Kingsland.
Committee :—
Mr. H. R. Evans, Court of Noke, Pembridge, Herefordshire.
Mr. A. E. Goodwin, Wilmaston, Peterchurch, Hereford.
Mr. C. Addison Hall, 34, Etnam Street, Leominster.

Spey Royal (Board's Premium).

Owner :—Mr. J. B. Dowding, Fairfield, Leominster.
Route :—Fairfield (Leominster), Monkland, Weobley, Burghill, Credenhill, Norton Canon, Dorstone, Hay, Whitney, Kinnersley, Kington, and Pembridge.
Committee :—
Mr. H. R. Evans, Court of Noke, Pembridge, Herefordshire.
Mr. C. Addison Hall, 34, Etnam Street, Leominster.
Capt. E. L. Heygate, Buckland, Leominster.

SALOP.

Jack Scarlett (King's Premium).

Owner :—Major H. Heywood-Lonsdale, Shavington Grange, Market Drayton.
Route :—Market Drayton, High Ercall, Shrewsbury, Oswestry, Ellesmere, and Whitchurch.
Committee :—
Mr. H. W. Fell, Shavington Grange, Market Drayton.
Mr. R. Hughes, F.R.C.V.S., Oswestry.
Mr. A. Mackenzie, F.R.C.V.S., Market Drayton.
Mr. T. Whitfield, 12, Talbot Chambers, Shrewsbury.

Neyland (Super Premium).

Owner :—Major H. Heywood-Lonsdale, Shavington Grange, Market Drayton.
Route :—Bridgnorth, Much Wenlock, Wellington, Newport, and Shifnal.
Committee :—
Mr. W. Bishop, Posenhall, Broseley, Salop.
Mr. W. H. Burton, Newport, Salop.
Mr. H. W. Fell, Shavington Grange, Market Drayton.
Mr. James Martin, M.R.C.V.S., Wellington, Salop.

Pedlar Brand (Board's Premium).

Owner :—Lieut-Col. David Davies, M.P., M.F.H., "Broneirion," Llandinam, Mont.

Route :—Ludlow, Bishop's Castle, Chirbury, Worthen, Pontesbury, Dorrington, Leebotwood, Church Stretton, and Craven Arms.

Committee :—

Mr. C. E. Dayus, M.R.C.V.S., Coton House, Craven Arms, Salop.

Mr. W. Kilvert, New House, Kempton, Lydbury North, Salop.

Mr. J G Lloyd Jones, The Offices, Llandinam, Mont.

Mr. Corbett Price, Leigh House, Minsterley, Shrewsbury.

Mr. H. E. Whitaker, M.F.H., Ludford Park, Ludlow.

DISTRICT CLASS 7.

Counties of Wales.

5 King's Premiums and 3 Board's Premiums.

ANGLESEY.

Money Spinner (*Board's Premium*).

Owner :—Mr. W. Hughes Jones, Fron, Llangefni, Anglesey.

Route :—Llanerchymedd, Llangefni, Valley, Pentraeth, and Bangor.

Committee :—

Mr. J. Coulthard, Beaumaris, Anglesey.

Mr. W. H. Jones, Fferam Rhosydd, Bodorgan, Anglesey.

Mr. R. W. Owen, Fferam Paradwys, Bodorgan, Anglesey.

Mr. O. Trevor Williams, M.R.C.V.S., Llangefni, Anglesey.

CARMARTHEN.

Sysonby (King's Premium).

Owners :—*Messrs. J. F. Rees and W. V. Howell Thomas*, 22, Lammas Street, Carmarthen.

Route :—Carmarthen, Nantcaredig, Llanarthney, St. Clears, Whitland, Llanboidy, and Mydrim.

Committee :—

Mr. R. H. Harries, The Croft, St. Clears, Carm.

Mr. E. Jones, Manoravon, Llandilo, Carm.

Mr. D. H. Thomas, Starling Park, Carmarthen.

GLAMORGAN.

Sanglamore (*King's Premium*).

Owners :—Messrs. J. F. Rees and W. V. Howell Thomas, 22 Lammas Street, Carmarthen.

Route :—Cowbridge, St. Fagans, *Llantwit-Major, Caerphilly, and* Abercynon.

Committee :—

Mr. E. T. Lloyd, West House, Llantwit-Major, Cardiff.

Mr. Iltyd Williams, Castleton, St. Athan, Cardiff.

Mr. R. H. Williams, M.F.H., The Ham, Llantwit-Major, Cardiff.

MONMOUTH.

Scipio (King's Premium).

Owners :—Messrs. J. F. Rees and W. V. Howell Thomas, 22, Lammas Street, Carmarthen.

Route :—Monmouth, Abergavenny, Usk, Pontypool, Newport, Caerleon, Magor, and Chepstow.

Committee :—

Mr. A. G. Burchardt-Ashton, Llandogo Priory, Chepstow.
Mr. C. B. Knight, Wyelands Farm, Chepstow.
Mr. A. M. Pilliner, Llanyravon, Newport, Mon.

MONTGOMERY.

Sea Flier (King's Premium).

Owner :—Lieut.-Col. David Davies, M.P., M.F.H., "Broneirion," Llandinam, Mont.

Route :—Llandinam, Newtown, Sarn, Montgomery, Forden, Welshpool, Pool Quay, Llanymynech, Garthmyl, Abermule, and Caersws.

Committee :—

Mr. T. Green, The Bank, Pool Quay, Welshpool.
Mr. E. C. Morgan, Crown Chambers, Newtown.
Mr. R. Morgan, Snowfield, Kerry, Mont.
Mr. E. R. Owen, Nag's Head, Garthmyl, Mont.

* **Ballinasloe** (Board's Premium).

Owner :—Lieut.-Col. David Davies, M.P., M.F.H., "Broneirion," Llandinam, Mont.

Route :—Manafon, Llanfair, Meifod, Llanfyllin, Llangedwyn, Llansantffraid, Guilsfield, Buttington, Churchstoke, and Berriew.

Committee :—

Mr. T. Green, The Bank, Pool Quay, Welshpool.
Mr. E. C. Morgan, Crown Chambers, Newtown.
Mr. R. Morgan, Snowfield, Kerry, Mont.
Mr. E. R. Owen, Nag's Head, Garthmyl, Mont.

PEMBROKE.

Just Cause (King's Premium).

Owner :—Mr. J. Griffiths, Jameston Court, Manorbier. Pembs.

Route :—Haverfordwest, Narberth, Tenby, and Pembroke.

Committee :—

Mr. J. Gibbon, Vaynor, Narberth, Pembs.
Mr. G. D. Llewellyn, Stephens Green, Milton, Pembroke.
Mr. T. G. Phelps, Cresselly, Begelly, Pembs.

PEMBROKE AND CARDIGAN.

Barbed Fence (Board's Premium).

Owner :—Mr. J. Griffiths, Jameston Court, Manorbier, Pembs.

Route :—Haverfordwest, Mathry, Letterston, Fishguard, Newport, Boncath, and Cardigan.

Committee :—

Mr. G. B. Bowen, Llwyngwair, Newport, Pembs.
Col. H. W. H. Brenchley, Glaneirw, Cardigan.
Mr. J. C. Yorke, Langton, Dwrbach, Pembs.

* *Hunter Stallion.*

DISTRICT CLASS 8.

Gloucester, Oxford, Warwick, and Worcester.
5 King's Premiums and 5 Board's Premiums.

GLOUCESTER.

Darigal (Super Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Gloucester, Stroud, Tetbury, Chipping Sodbury, and Berkeley Road.
Committee :—
Mr. J. Pearce Ellis, Maisemore Court, Gloucester.
Col. F. Henry, Elmestree, Tetbury.
Mr. Aubrey Miller, Badminton, Glos.

John Lambton (*Super Premium*).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Cirencester, Fairford, Burford, Kingham, Lower Slaughter, and Northleach.
Committee :—
Mr. P. Barnett, 4, Bromley Terrace, Cirencester.
Mr. E. T. Pritchard, Donnington Manor, Moreton-in-Marsh, Glos.
Mr. A. Rixon, Turkdean Manor, Northleach, Glos.

Garborian (Board's Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Cheltenham, Newnham, Newent, Tewkesbury, and Winchcombe.
Committee :—
Mr. Granville Acworth, Hill Ash, Dymock, Gloucester.
Mr. H. Dent-Brocklehurst, Sudeley Castle, Winchcombe, Glos.
Mr. J. Gibbons, Boddington Manor, Cheltenham.
Mr. H. C. Holmes, Ruddle, Newnham, Glos.

OXFORD.

Grey Antler (Board's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.
Route :—Begbroke, Bicester, Oxford, Witney, Charlbury, Woodstock, and Heyford.
Committee :—
Mr. R. K. Macpherson, Randolph Hotel Stables, Oxford.
Mr. G. Mansfield, Spring Hill House, Hethe, Bicester.
Mr. B. W. Millington, Deddington, Oxford.

WARWICK.

King of the Wavelets (King's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.
Route :—Moreton Morrell, Southam, Shuckburgh, Dunchurch, Rugby, Pailton, Brinklow, Brandon, Offchurch, and Ufton.
Committee :—
Mr. J. B. Johnson, Manor House, Willoughby, Rugby.
The Hon. C. Portman, Goldicote, Stratford-on-Avon.
Mr. E. Ringer, M.R.C.V.S., Guy Street, Leamington Spa.

Newmarket (Super Premium).

Owner :—Lord Willoughby de Broke, Compton Verney, Warwickshire.

Route :—Kineton, Wellesbourne, Hampton Lucy, Stratford-on-Avon, Oxhill, Fenny Compton, and Radway.

Committee :—

Lord Willoughby de Broke, Compton Verney, Warwickshire.
Mr. C. Kendal, Mount Pleasant, Walton, Warwick.
Mr. J. Lea, Charlecote, Warwick.
Mr. J. Wilkes, Tredington, Shipston-on-Stour.

Roi Donovan (Board's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.

Route :—Henley-in-Arden, Coleshill, Nuneaton, Coventry, Kenilworth, Warwick, Beoley Cross, and Hockley Heath.

Committee :—

Mr. J. P. Arkwright, Hatton House, Warwick.
Mr. T. M. Burman, Braggs Farm, Shirley, Birmingham.
Mr. H. Stubbs, Camp Hill Hall, Nuneaton.

WORCESTER.

Puro Caster (King's Premium).

Owner :—Lord Willoughby de Broke, Compton Verney, Warwickshire.

Route :—Worcester, Droitwich, Bromsgrove, and Redditch.

Committee :—

Major J. Baldwin, Groveley Hall, Coston-Hackett, Birmingham.
Mr. R. Cottrill, Sandal Lodge, Droitwich.
Mr. A. Jones, Ombersley, Droitwich.

Christmas Greeting (Board's Premium).

Owner :—Mr. T. J. Hillman, Stud Farm, Stock Wood, Redditch.

Route :—Inkberrow, Evesham, Pershore, Eckington, Bredon, Severn Stoke, Kempsey, and Upton Snodsbury.

Committee :—

Col. A. H. Hudson, Wick House, Pershore, Worcs.
Mr. A. Jones, Ombersley, Droitwich.
Mr. G. Dudley Smith, Strensham Court, Worcester.

Keystone (Board's Premium).

Owner :—Mr. W. P. Pope, Brockamin, Leigh, Worcester.

Route :—Leigh, Knightwick, Suckley, Cradley, Malvern, Hanley Castle, Upton-on-Severn, Staunton, Madresfield, and Powick.

Committee :—

Mr. W. J. Gresson, Birlingham, Pershore, Worcs.
Mr. G. Dudley Smith, Strensham Court, Worcester.
Mr. T. Lawson Walker, Knightwick Manor, Worcester.

DISTRICT CLASS 9.

Bedford, Hunts. Leicester, Northampton, Rutland, and Soke of Peterborough.

5 King's Premiums and 2 Board's Premiums.

BEDFORD.

Ulpian (King's Premium).

Owner :—Mr. D. Fraser, Tickford Park, Newport Pagnell.

Route :—Moulsoe, Cranfield, Kempston, Bromham, Harrold, Thurleigh, Great Barford, Sandy, Broom, Shefford, Ampthill, and Woburn.

Committee :—

Mr. G. E. Brown, Marston Moretaine, Ampthill.
Mr. B. Howkins, Bromham, Bedford.
Mr. H. King, Broom, Biggleswade.
Mr. J. C. H. Robinson, Marsh Leys, Kempston, Bedford.
Mr. S. Seymour, "The Lodge," Ampthill.

HUNTS.

Bachelor's Charm (Super Premium).

Owner :—Lieut.-Col. David Davies, M.P., M.F.H., "Broneirion," Llandinam, Mont.

Route :—Huntingdon, St. Ives, Somersham, Pidley, Ramsey, Alconbury, St. Neots, Stoughton, and Ellington.

Committee :—

Mr. H. Cranfield, Buckden, Huntingdon.
Mr. G. Fuller, Alconbury Manor, Huntingdon.
Mr. F. Goodliff, Montagu House, Huntingdon.
Mr. A. Jordan, Wistaria House, St. Neots.
Mr. J. P. Pentelow, Tollington House, Somersham, St. Ives, Hunts.

LEICESTER.

Take Care (King's Premium).

Owner :—Mr. R. L. Fenwick, Little Belvoir, Melton Mowbray.

Route :—Melton Mowbray, Waltham, Knipton, Six Hills, Wymeswold, Loughborough, Walton-on-the-Wolds, and Asfordby.

Committee :—

Mr. H. S. Black, Frisby-on-the-Wreake, Leicester.
Mr. J. B. Tidmas, Normanton-on-Soar, Loughborough.
Mr. David Ward, Bescaby, Melton Mowbray.

Cecilian (Board's Premium).

Owner :—Mr. H. T. Hincks, Wigston Hall, Leicester.

Route :—Wigston, Kibworth, Cosby, Kirkby Mallory, Market Bosworth, Osbaston, Nailstone, Anstey, Woodhouse Eaves, Quorn, Wanlip, Leicester, and Burton Overy.

Committee :—

Mr. S. Nevins Bankart, Hazeldene, London Road, Leicester.
Mr. R. Bingley, Smeeton Westerby, Leicester.
Mr. J. Nelson, Kirkby Mallory, Hinckley.
Mr. G. M. Pettifor, Anstey, Leicester.

NORTHAMPTON.

Chanteur (Super Premium).

Owner :—Mr. J. Drage, Chapel Brampton, Northampton.

Route :—Chapel Brampton, Northampton, Wellingborough, Kettering, and Market Harborough.

Committee :—

Mr. J. Brown, Earl's Barton House, Northampton.
Mr. E. Messinger, Chapel Brampton, Northampton.
Mr. H. R. Roe, Cranoe, Market Harborough.

Snap Dragon (King's Premium).

Owner :—Mr. J. Drage, Chapel Brampton, Northampton.

Route :—Chapel Brampton, Harlestone, Blisworth. Towcester, Brackley, Daventry, and West Haddon.

Committee :—

Mr. J. G. Lawrence, Newnham, Daventry.
Mr. W. Murland, Badby House, Daventry.

RUTLAND.

William Cope (Board's Premium).

Owner :—Mr. G. E. Gibson, M.R.C.V.S., Oakham.

Route :—Oakham, Braunston, Loddington, Hallaton, Thorpe-by-Water, Glaston, Luffenham, Wymondham, Stapleford, and Whissendine.

Committee :—

Mr. S. Nevins Bankart, Glaston, Uppingham.
Mr. G. E. Gibson, M.R.C.V.S., Oakham.
Mr. J. M. Northern, Thorpe-by-Water, Uppingham.

DISTRICT CLASS 10.

Cambridge, Isle of Ely, Norfolk, and Suffolk.
3 King's Premiums and 2 Board's Premiums.

NORFOLK.

Sea Bath (King's Premium).

Owners :—The Executors of the late R. W. Palmer, Swafield House Stud Farm, North Walsham, Norfolk.

Route :—North Walsham, Acle, Loddon, Harleston, Wymondham, and Norwich.

Committee :—

The Rev. A. Fellowes, Shotesham Vicarage, Norwich.
Mr. E. D. Horsefield, Antringham, North Walsham, Norfolk.
Mr. T. O. Springfield, Aldburgh House, Harleston.

Adular (Board's Premium).

Owners :—Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Route :—Stow, Narborough, Massingham, Stanhoe, Hunstanton, and King's Lynn.

Committee :—

Mr. A. E. Birch, Watlington Hall, Downham Market.
Mr. G. Brereton, Flitcham Hall, King's Lynn.
Mr. J. Dennick, Valinger House, King's Lynn.
Mr. W. Goodwyn, East Winch, King's Lynn.
Mr. R. Monson, Walpole St. Peter, Wisbech.

***Gateboy** (Board's Premium).

Owners :—The Association of Farmers in Norfolk, *per* Mr. H. Overman, Kipton House, Weasenham St. Peter, Swaffham.

Route :—Dunston Hall, Swaffham, Pickenham, Cley, Westacre, Rougham, Lexham, Litcham, Raynham, Weasenham St. Peter, East Rudham, Burnham, Creake, Fakenham, Aylsham, and East Dereham.

Committee :—

Col. G. F. Buxton, Dunston Hall, Norwich.
Major A. Collison, Weyland, Cromer.
Mr. F. D. Ives, The Grange, Erpingham, Norwich.
Mr. H. Overman, Kipton House, Weasenham St. Peter, Swaffham.

SUFFOLK.

Popoffka (King's Premium).

Owner :—Mr. Philip Palmer, Thornham, Eye, Suffolk.

Route :—Thornham Magna, Eye, Bury St. Edmunds, Haverhill, Long Melford, and Stowmarket.

Committee :—

Mr. P. Brown, Rushbrooke, Bury St. Edmunds.
Mr. S. Jaggard, The Queech, Pakenham, Bury St. Edmunds.
Mr. H. Westrop, Long Melford.

The Tailor (King's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.

Route :—Ipswich, Woodbridge, Saxmundham, Blytheburgh, Halesworth, and Beccles.

Committee :—

Mr. R. Nestling, White House, Earl Soham, Framlingham, Suffolk.
Mr. L. Parry, Halesworth.
Mr. H. Phillips, 14, Museum Street, Ipswich.

DISTRICT CLASS 11.

Bucks, Essex, Herts, and Middlesex.

3 King's Premiums and 1 Board's Premium.

BUCKS.

Bobrikoff (King's Premium).

Owner :—Mr. E. W. Robinson, Liscombe, Leighton Buzzard.

Route :—Liscombe, Aston Abbotts, Whitchurch, Winchendon, Long Crendon, Brill, Steeple Claydon, and Winslow.

Committee :—

Mr. T. W. Lepper, M.R.C.V.S., Aylesbury.
Mr. J. D. Tomes, Denham Hill, Quainton, Aylesbury.
Mr. E. M. Weatherby, Manor House, Brill, Thame.

* Hunter Stallion.

Sundawn (King's Premium).

Owner :—Mr. Donald Fraser, Tickford Park, Newport Pagnell.
Route :—Newport Pagnell, Cosgrove, Hanslope, Stony Stratford, Buckingham, and Fenny Stratford.
Committee :—
Mr. F. W. Coales, Lathbury, Newport Pagnell.
Mr. M. Grimes, Tickford Park Stud, Newport Pagnell.
Mr. C. D. Pennant, Lillingstone Dayrell, Buckingham.

ESSEX.

Captain Jack (King's Premium).

Owner :—Mr. A. S. Bowlby, Gilston Park, Harlow.
Route :—Bishop's Stortford, Dunmow, Braintree, Witham, Chelmsford, Ongar, and Harlow.
Committee :—
Mr. T. Christy, Roxwell, Chelmsford.
Mr. J. Hughes, Gilston Park, Harlow.
Mr. A. Waters, Coopersale Lodge, Epping.
Mr. J. Bishop Young, F.R.C.V.S., Braintree.

HERTS.

Flying Scot (Board's Premium).

Owner :—Mr. Hugh Arnold, Crews Hill Paddocks, Enfield, Middlesex.
Route :—Barnet, Elstree, Bushey, Aldenham, St. Albans, Harpenden, Wheathampstead, Hatfield, Hertford, Hoddesdon, Waltham Cross, and Enfield.
Committee :—
Mr. J. Bell, Cattlegate, Enfield, Middlesex.
Mr. J. C. McCowan, Hatfield.
Capt. W. P. Jeffcock, West Common, Harpenden, Herts.
Mr. S. H. Wall, Homestead Stud Farm, Barnet.

DISTRICT CLASS 12.

Kent, Surrey, and Sussex (East and West).

4 King's Premiums and 3 Board's Premiums.

KENT.

Stortford (King's Premium).

Owner :—Capt. H. Faudel Phillips, Mapleton Stud, Eden Bridge.
Route :—Eden Bridge, Tonbridge, Paddock Wood, Maidstone, Kemsing, and Sevenoaks.
Committee :—
Mr. Malcolm R. Aird, East Sutton Place, Maidstone.
Mr. G. Arnold, Hale Place, East Peckham, Paddock Wood, Kent.
Mr. W. M. Brydone, The Kennels, Otford, Sevenoaks.
Mr. T. P. Hirons, Linton Park, Maidstone.

John Splendid (Board's Premium).

Owner :—Mr. J. C. Buckland, Goldwell, Great Chart, Ashford.

Route .—Great Chart, Tenterden, Sissinghurst, Faversham, and Canterbury.

Committee :—

Mr. M. R. Aird, East Sutton Place, Maidstone.
Mr. B. Cheeseman, Sissinghurst Castle, Cranbrook.
Mr. T. P. Hirons, Linton Park, Maidstone.
Capt. Somerset Webb, Henghurst, Woodchurch, Ashford.

SURREY AND WEST SUSSEX.

Jingling Geordie (King's Premium).

Owners :—The Cobham Stud, Cobham, Surrey.

Route :—Cobham, Godalming, Chiddingfold, Petworth, Arundel, Chichester, Midhurst, and Petersfield.

Committee :—

Mr. A. Day, Fontwell, Arundel.
Mr. F. H. Sawtell, Langford, Lavant, Chichester.
Commander Warren, Nyewood House, Petersfield.
Mr. J. B. Watson, Estate Office, Petworth.

Wisemac (Super Premium).

Owners :—The Cobham Stud, Cobham, Surrey.

Route :—Cobham, Guildford, Cranleigh, Horsham, Three Bridges, Gatwick, Reigate, Red Hill, Betchworth, Dorking, and Leatherhead.

Committee :—

Mr. C. W. Howard, M.R.C.V.S., 41, High Street, Dorking.
Mr. W. G. Langlands, Epsom.
Mr. S. Marsh, Red Hill.
Mr. A. Mitchell, The Burtleys, Frensham, Farnham.
Mr. H. H. Roberts, M.R.C.V.S., Leatherhead.
Mr. J. A. White, 18, High Street, Dorking.

WEST SUSSEX.

***The Best** (Board's Premium).

Owner :—Major Sir Merrik R. Burrell, Bart., Knepp Castle, Horsham.

Route :—Knepp, Billingshurst, Pulborough, Washington, Sompting, Lancing, Steyning, Partridge Green, and West Grinstead.

Committee :—

Mr. E. Brown, Knepp Castle Stud Farm, West Grinstead.
Mr. A. G. Hecks, Sullington Manor Farm, Pulborough, Sussex.
Mr. J. B. Watson, Estate Office, Petworth.

* Hunter Stallion.

EAST SUSSEX.

Strickland (King's Premium).

Owner :—Mr. H. P. Nickalls, The Kennels, Horley.

Route :—Polegate, East Hoathly, Mayfield, Wadhurst, Ticehurst, Robertsbridge, Westfield, and Battle.

Committee :—

Mr. J. E. Muggeridge, New Place, Framfield, Uckfield.
Mr. H. T. Simmons, Wychnour, Battle, Sussex.
Mr. T. Kirby Stapley, M.F.H., The Kennels, Catsfield, Battle, Sussex.

Rockaway (Board's Premium).

Owner :—Mr. C. Kelway-Bamber. "Priestlands" Stud, Martyrs, Crawley.

Route :—Hurstpierpoint, Lewes, Uckfield, East Grinstead, and Haywards Heath.

Committee :—

Mr. J. Hodson, Kingston, Lewes.
Mr. W. F. Ingram, 2, St Andrew's Place, Lewes
Mr. Watkin James, Fir Grove, Burgess Hill. Sussex.
Mr. H. F. Sturdy, Felcourt, East Grinstead.

DISTRICT CLASS 13.

(Berks, Hants, and Isle of Wight).
3 King's Premiums and 3 Board's Premiums.

BERKS.

General Stössel (King's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.

Route:—Twyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Strathfieldsaye, Hartley Row, Odiham, and Yateley.

Committee :—

Sir Robert R. Wilmot, Bart., Binfield Grove, Bracknell.

Lorello (Board's Premium).

Owner :—Mr. T. J. Hillman, Stud Farm, Stock Wood, Redditch.

Route :—Shrivenham, Faringdon, Challow, Goosey, Kingston Bagpuze, Abingdon, Steventon, and Buscot.

Committee :—

Mr. L. A. Barrett, Milton, Steventon, Berks.
Mr. W. Crosland, Estate Office, Buscot Park, Faringdon.
Col. The Hon. H. G. Henderson, M.P., Kitemore, Faringdon.
Mr. E. Robson, Stockham, Wantage.

HANTS.

Egret (King's Premium).

Owner :—Mr. J. E. A. Willis-Fleming, Stoneham Park, Eastleigh, Hants.

Route :—Romsey, Whiteparish, Salisbury, Over Wallop, Andover, and Stockbridge.

Committee :—

Mr. G. Eyre-Matcham, Newhouse, Redlynch, Salisbury.
Mr. J. E. A. Willis-Fleming, Stoneham Park, Eastleigh, Hants.

Thorndyke (King's Premium).

Owner :—Mr. H. Arnold, Crews Hill Paddocks, Enfield, Middlesex.

Route :—Bishop's Waltham, Tichborne, Alton, Basingstoke, Whitchurch, and Hursley Park.

Committee :—

Mr. R. Austin, Bishop's Waltham, Hants.
Mr. J. F. Complin, Holybourne, Alton.
Mr. F. Coryton, The Manor House, Greatham, Liss, Hants.
Mr. T. A. Edney-Hayter, The Mount, Whitchurch, Hants.
Sir Richard Rycroft, Bart., Dummer House, Basingstoke.

St. Francis (Board's Premium).
Owner :—Mr. W. de P. Cazenove, Pimperne, Blandford.
Route :—Breamore, Ringwood, Brockenhurst, Lymington, and Christchurch.
Committee :—
Mr. C. Imeson, Efford Mill, Lymington.
Mr. G. G. Lander, Purewell Farm, Christchurch.
Mr. C. Stanford, Breamore, Salisbury.
Mr. T. Stovold, Harrow Farm, Bransgore, Christchurch.

ISLE OF WIGHT.

Square Root (Board's Premium).
Owner :—Dr. W. J. Jolliffe, Yafford House, Shorwell, Newport, Isle of Wight.
Route :—Shorwell, Sandown, Ryde, Yafford, and Freshwater.
Committee :—
Mr. J. Attrill, Waytescourt, Brighstone, Newport, Isle of Wight.
Capt. H. Collingwood Bertram, West Standen, Newport, Isle of Wight.
Major Gen. Fetherstonhaugh, Gwydyr House, Ryde, Isle of Wight.

DISTRICT CLASS 14.

Dorset, Somerset, and Wilts.
6 King's Premiums and 3 Board's Premiums.

DORSET.

Gilgandra (Super Premium and Reserve for King's Champion Challenge Cup).
Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Bagber, Wimborne, Horton Inn, Blandford, and Iwerne Minster.
Committee :—
Mr. T. Bartlett, Screech Hill, St. Giles, Cranborne, Salisbury.
Mr. R. Cave, Almer, Blandford.
Mr. W. C. Martin, Moor Court, Wimborne.

Magnum Charter (Board's Premium).
Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Puddletown, Dorchester, Cerne Abbas, Bridport, and Beaminster.
Committee :—
Col. H. Alexander, D.S.O., Chetnole, Sherborne.
Col. Brough, 56, High West Street, Dorchester.
Mr. F. Pope, Toller, Dorchester.

SOMERSET.

Bagotstown (Super Premium).
Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Yeovil, Kingsdon, Curry Rivel, Taunton, Chard, and Crewkerne.
Committee :—
Capt. G. Phipps Hornby, Somerton Erleigh, Somerton, Somerset.
Mr. J. F. Neal, Kingsdon, Taunton.
Mr. T. White, Gate House, Taunton.

Persimmon's Pride (King's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.
Route :—Norton Hill, Farrington Gurney, Midsomer Norton, Radstock, Faulkland, Norton St. Philip, Timsbury, Paulton, Clutton, Highbury, and Holcombe.
Committee :—
Mr. L. B. Beauchamp, Norton Hall, Bath.
Mr. G. W. Haydon, M.R.C.V.S., Midsomer Norton, Bath.

Sandow (King's Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Shepton Mallet, Glastonbury, Bruton, and Frome.
Committee :—
Mr. L. B. Beauchamp, Norton Hall, Bath.
Mr. A. C. Clarke, Red Lion Hotel, Shepton Mallet.

Bridge of Orchy (Board's Premium).

Owners :—The Bingham Lodge Stud, Chard.
Route :—Keynsham, Long Ashton, Portishead, Clevedon, Yatton, Congresbury, Worle, Banwell, Blagdon, and Harptree.
Committee :—
Mr. R. A. Bowring, Rockhill, Keynsham, Bristol.
Mr. E. A. Hardwick, 65, Moorland Road, Weston-super-Mare.
Mr. T. H. Pearce, Long Ashton, Bristol.

Chalk Stream (Board's Premium).

Owner :—Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.
Route :—Dulverton, Wellington, Wiveliscombe, Williton, and Minehead.
Committee :—
Mr. H. H. Sweet Escott, Bicknoller, Taunton.
Mr. C. L. Hancock, Cothelstone Manor, Taunton.
Mr. D. J. Tapp, Higher Combe, Dulverton.

WILTS.

Red King (King's Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Chippenham, Melksham, Westbury, Devizes, and Calne.
Committee :—
Mr. F. Doble, Berwick Bassett, Swindon.
Mr. C. Garnett, Great House, Kington Langley, Chippenham.
Mr. W. Preston, M.F.H., Seend, Melksham.

Renown (Super Premium).

Owners :—The Compton Stud, Sandley, Gillingham, Dorset.
Route :—Swindon, Wootton Bassett, Malmesbury, Cricklade, and Highworth.
Committee :—
Mr. H. Baker, Chedglow Manor, Crudwell, Malmesbury.
Mr. H. C. Sutton, Holdcroft, Blunsdon, Highworth, Swindon.
Mr. G. Buxton, Tottenham Manor, Wootton Bassett.

DISTRICT CLASS 15.

Cornwall and Devon.

3 King's Premiums and 1 Board's Premium.

CORNWALL.

Golden Grebe (King's Premium).

Owners :—Messrs. W. & H. Whitley, Primley Farm, Paignton

Route :—Liskeard, St. Austell, Penzance, Redruth, Truro, Mitchell, St. Columb, and Wadebridge.

Committee :—

Mr. C. Burleigh, Sportman's Arms, Menheniot Station, Liskeard.
Mr. Coulter Hancock, 12, Princes Street, Truro.
Mr. H. G. P. Hoblyn, Colquite, Washaway, Cornwall.
Mr. Brooking Trant, Trethawle, Liskeard.
Mr. T. Yeo, St. Leonards, Bodmin.

DEVON.

Marzio (King's Premium).

Owner :—Mr. M. J. Taylor, Ermington, Ivybridge, Devon.

Route :—Ermington, Plympton, Ivybridge, Brent, Totnes, Newton Abbot, Dawlish, and Exeter.

Committee :—

Mr. P. G. Bond, M.R.C.V.S., 105, Union Street, Plymouth.
Mr. A. Hingston, Bridgetown, Totnes.
Mr. C. Harris Pitts, South Allington, Kingsbridge.
Mr. T. Willing, Bulleigh Barton, Ipplepen, Newton Abbot.

Wuffy (King's Premium).

Owner :—Mr. A. G. Parsons, Kilmington Stud, Axminster.

Route :—Axminster, Honiton, Exeter, and Tiverton.

Committee :—

Mr. Ian H. Amory, Knightshayes Court, Tiverton.
Mr. R. J. Brown, Boro' House, Axmouth, Axminster.
Mr. C. Foward, Solicitor, Axminster.
Mr. H. W. Gould, 2, Bedford Circus, Exeter.
Mr. G. D. Lansley, M.R.C.V.S., Axminster.

Terra-Cotta (Board's Premium).

Owner :—Mr. C. Kelway-Bamber, "Priestlands" Stud, Martyrs, Crawley.

Route :—Okehampton, Crediton, Torrington, Bideford, Barnstaple, and Tavistock.

Committee :—

Mr. T. B. Fairchild, Torrington, Devon.
Mr. A. C. Godfrey, Tavy Cottage, Tavistock.
Mr. E. P. Northey, Higher Bowden, Okehampton.
Mr. H. Turner, The Barton, Instow, Devon.

All the Stallions are thoroughbred except where otherwise indicated.

OFFICIAL NOTICES AND CIRCULARS.

The following notice was issued by the Board on 19th April, 1916:—

Notice to Farmers: Military Service.

1. His Majesty's Government have decided that as many as possible of young unmarried men, who can be spared without serious detriment to essential national services, shall be released for service in the Army, and that Agriculture, in common with other national industries, must submit to a revision of the List of Certified Occupations.

2. It is necessary, therefore, in the national interest, to review the exemptions granted to certain classes of agricultural workers, but, as was stated in the House of Commons on the 22nd March last, on behalf of the Prime Minister, "*it must not be supposed that in taking this action the Government have failed to realise the importance of maintaining the highest possible output of home-grown food supplies, which remains a national object of a most essential nature. We should deprecate the removal from work on the land of labour which is really essential and irreplaceable for this purpose.*"

3. The Board of Agriculture and Fisheries have certified, after consultation with the Army Council, that the work of men in the following list of agricultural occupations is work of national importance, and that subject to the provisions as to individual certificates contained in the Regulations and Instructions, the classes or bodies of men who are employed in these occupations, and who fulfil the conditions specified as to age, marital condition, and date of entering their present occupation, are exempted from the provisions of the Military Service Act, 1916, or, if they are voluntarily attested men, from being called up for military service.

List of Certified Occupations.

4. The amended list of Agricultural "Certified Occupations" *from the 1st May*, 1916, is as follows:—

Farmer (including Market Gardener and Fruit Farmer)—Provided that—

(*a*) farming is his sole occupation and his personal labour or superintendence is indispensable for the proper cultivation of his holding; or

(*b*) if he is partly occupied in another occupation, his personal labour or superintendence is indispensable for the proper cultivation of his holding and such cultivation is expedient in the national interest.

Agricultural Machinery, Steam Ploughs and Threshing Machines:—Attendant; Driver; Mechanic.

Farm—Bailiff, Foreman, Grieve, Steward (*unmarried men not exempted up to the age of* 30).

Farm—Beastman, Byreman, Cattleman, Stockman, Yardman; ,, Carter, Horseman, Ploughman, Teamster, Wagoner; ,, Hind (if Foreman or Ploughman); ,, Servant (if Foreman or Ploughman) Scotland.	(*Unmarried men not exempted up to the age of* 25.)

Shepherd.

Thatcher.

Stallion Man (a man who looks after and travels a Stallion).
Stud Groom (Scotland).
Hop, Fruit and Market Gardens :—Foreman. (*Unmarried men not exempted up to the age of* 25.)

NOTE.—*Age means the age of the man on the* 1*st May*, 1916.

The only persons entitled to be exempted on account of being employed in the "certified occupations" are those whose principal and usual occupation is one of those included in the above List. By the use of the term "principal and usual occupation" it is intended to exclude from exemption those persons who may be only occasionally employed in work of a kind similar to that of one of the occupations, but who do not follow it in any regular fashion and are not really engaged in the occupation in the proper sense of the word.

5. Unmarried men in any of the occupations included in the List are covered only if they can show that they were engaged in the same occupation *on or before the date when the National Register was made, namely, the* 15*th August*, 1915.

Men who on the 2nd November, 1915, were unmarried or were widowers without any child dependent on them are to be treated as unmarried men for the purposes of the List.

6. *The men who will cease to be included in the List of Certified Occupations on the* 1*st May*, 1916, *are as follows* :—

(*a*) Farm—Bailiff, Foreman, Grieve, Steward. Unmarried men under the age of 30.

,, Beastman, Byreman, Cattleman, Stockman, Yardman ;	Unmarried men under the age of 25.
,, Carter, Horseman, Ploughman, Teamster, Wagoner ;	
,, Hind (if Foreman or Ploughman) ;	
,, Servant (if Foreman or Ploughman), Scotland.	

Hop, Fruit and Market Gardens :—Foreman. Unmarried men under the age of 25.

(*b*) Men who were not engaged in the same occupation on or before the 15th August, 1915, as that in which they are now engaged.

As a result a certificate of exemption given to any man within those classes *on the ground that he was engaged in a certified occupation* will automatically cease to be in force on the 1st May, no matter what period of exemption may have been granted previously by a Tribunal, and it will be necessary to make a fresh application for the renewal of his certificate of exemption *on the ground that his services are still indispensable*—if that is so—(see paragraphs 8, 9, and 10 of this Memorandum).

If, therefore, farmers think it necessary to retain the services of any of their men whose certificates of exemption will expire on 1st May, *they should apply to the Local Tribunal for a renewal of the certificate of exemption*.

For instance, an unmarried carter, aged 24, may have obtained a certificate of exemption up to (say) 30th of September, 1916. The effect of the new arrangements will be that his certificate will expire on 1st May, and, if his services are still indispensable, application for a renewal of the certificate should be made before 1st May, or not later than seven days after individual notice has been sent to the man by the

Military Authorities calling him up for service with the Colours, if he was voluntarily attested; or before 1st July if he was not voluntarily attested.

7. The effect of these changes will be that instead of there being a presumption that the men concerned will receive certificates of exemption from the military service, unless objection is made by the Military Representative, *the duty of showing that the men are absolutely indispensable for the cultivation of the farm or the maintenance of the head of livestock will be thrown on the farmers*, and they will have to satisfy the Local Tribunals in each particular case that it is in the national interests that the men should continue in their civil employment.

Grounds on which a certificate of exemption may be claimed by or in respect of—

(*a*) *a man whose occupation is not included in the List of Certified Occupations;*

(*b*) *an unmarried man who was not in his present occupation on or before the 15th August, 1915.*

8. Claims may be made—

(*a*) on the ground that it is expedient in the national interests that the man should, instead of being employed in military service, be engaged in other work in which he is habitually engaged;

(*b*) on the ground that it is expedient in the national interests that the man should, instead of being employed in military service, be engaged in other work in which he wishes to be engaged;

(*c*) if the man is being educated or trained for any work, on the ground that it is expedient in the national interests that, instead of being employed in military service, he should continue to be so educated or trained;

(*d*) on the ground that serious hardship would ensue if the man were called up for Army service, owing to his exceptional financial or business obligations or domestic position;

(*e*) on the ground of ill-health or infirmity;

(*f*) on the ground of a conscientious objection to the undertaking of combatant service;

and the Local Tribunal, if they consider the grounds of the application established, shall issue such a certificate to the man in respect of whom the application is made.

9. An application for a certificate of exemption may be made by or in respect of a man who has voluntarily attested on any of the grounds mentioned in the preceding paragraph, with the exception of (*e*) and (*f*).

Period within which application for a Renewal of a Certificate of Exemption is to be made.

10. In the case of a man to whom the Military Service Act applies, application for renewal must be made before or within two months after the date on which the certificate ceases to be in force.

In the case of voluntarily attested men the application for renewal may be made before the date on which the certificate ceases to be in force or not later than seven days after individual notice has been sent to the man by the Military Authorities calling him up from the Reserve for service with the Colours.

Forms of application must be obtained.

11. Applications for exemption must be made *in duplicate on the prescribed form which may be obtained from the Clerk of the Local Tribunal*, and which it is his duty to be prepared to supply.

How to obtain and send in Forms.

12. Applications for forms, and forms of application when filled up, must be addressed to the Office of the Clerk to the Local Tribunal, and may be delivered at or sent by post to that Office.

How Voluntarily Attested Men engaged in Certified Occupations should Proceed.

13. It is open to a voluntarily attested man (or someone on his behalf), provided that, in the case of an unmarried man, he was in the same occupation on or before the 15th August, 1915, to go or to write to the Recruiting Officer and to claim exemption on the ground that his principal and usual occupation is a "certified occupation." If the Recruiting Officer is satisfied, he can issue forthwith to the man a card corresponding to a Certificate of Exemption and mark him as exempted in the Army Register without any formal proceedings before the Local Tribunal.

As a rule, therefore, such men need not make application to the Local Tribunal except in cases in which their claim for exemption has been disputed by the Recruiting Officer or where they wish to have a formal Certificate of Exemption.

Where such a man desires a formal Certificate of Exemption, it is necessary for him to make application to the Local Tribunal.

The application must be made in duplicate on the prescribed form, and must be made—

- (*a*) if the man receives an individual notice calling him up from the Reserve for service with the Colours—*not later than seven days after the notice has been sent to the man by the Military Authorities.*
- (*b*) in the case of a man who is voluntarily attested, and who is placed in a group in Section B, Army Reserve, *after* the Public Notice calling up that group has been issued by the Military Authorities—*not more than ten days after the date on which he is voluntarily attested.*

Period within which Application must be made by a man who Attests voluntarily and who is not engaged in a Certified Occupation.

14. An application must be delivered to the Local Tribunal in the prescribed form in duplicate :—

- (*a*) *not later than ten days after the issue of the Public Notice calling up the group in which the man is placed;* or
- (*b*) in the case of a man who is voluntarily attested, and who is placed in a group in Section B, Army Reserve, *after* the Public Notice calling up that group has been issued by the Military Authorities—*not more than ten days after the day on which he is voluntarily attested.*

Certificates of Exemption.

15. A certificate of exemption may be absolute, conditional or temporary. "Absolute" means without any specified conditions or limit of time; "conditional" means subject to any conditions stated on the certificate; and "temporary" means granted for a definite period specified on the certificate. *All certificates will be open to review.*

Appeals from decision of Local Tribunals must be made within three days.

16. Appeal Tribunals have been established to which an appeal may be made by any person dissatisfied with the decision of the Local Tribunal or by the Military Authorities. The Appeal must be made *not later than three clear days after the decision of the Local Tribunal*, and proper forms for the purpose may be obtained from the Clerk to the Local Tribunal. Further appeal may be made by leave of the Appeal Tribunal from that Tribunal to the Central Tribunal, but it is not intended that cases shall come before the Central Tribunal unless important questions of principle are involved, or unless there is some other special reason why an appeal should be allowed.

Applicants for Exemption not to be Called up for Military Service while their Applications are still under consideration.

17. *Where an application has been made* to a Local Tribunal or *where Notice of Appeal to the Appeal Tribunal has been given* in the proper form and within the prescribed time the man in respect of whom such application or notice of appeal has been made is *not liable to be called up for service* with the Colours until his case has been finally disposed of. If through inadvertence a Notice calling up the man for service with the Colours is sent to him while his case is under consideration, *he should at once communicate with the Recruiting Officer and inform him of the facts of the case in order that the Notice may be cancelled.*

Powers of Military Representative in regard to Applications by Men for Certificates of Exemption and to Withdrawals or Variations of Certificates when Granted.

18. Where a man either holds a certificate of exemption, or, in the case of a voluntarily attested man, his name is marked in the Military Classification Register as not to be called up for service with the Colours on the ground that he is engaged in a "certified occupation" the Military Representative may apply to the Local Tribunal for a decision that the man should be rendered available to be called up for service with the Colours upon the following grounds, or one of them :—

(1) That the man's principal and usual occupation is not, in fact, one of the "certified occupations" ; or

(2) That, notwithstanding the man's principal and usual occupation is one of the "certified occupations," it is no longer necessary in the national interests that he should continue in civil employment ; or

The Military Representative may object on the same grounds to a certificate of exemption being granted.

The Military Representative may also apply at any time to the Local Tribunal for the withdrawal or variation of a certificate of exemption granted to a man on grounds other than that he was engaged in a certified occupation.

Military Service Act, 1916.

19. The Military Service Act, 1916, applies to all British subjects who :—

(1) Were ordinarily resident in Great Britain on the 15th August, 1915, or have become or hereafter become ordinarily resident in Great Britain since that date ;

(2) had attained the age of 18 years on the 15th August, 1915, and had not attained the age of 41 before the "appointed date" (2nd March, 1916) ;

(3) were on the 2nd November, 1915, single or were widowers without children dependent on them

subject to certain exceptions, amongst which are :—

(*a*) members of His Majesty's Regular or Reserve Forces ;

(*b*) men who have left or been discharged from the Naval or Military Service of the Crown in consequence of disablement or ill-health ;

(*c*) men who have offered themselves for enlistment and have been rejected since the 14th day of August, 1915.

The Act does not apply to men who voluntarily attest under the Group System (commonly known as Lord Derby's Scheme) in Section B, Army Reserve, and who are entitled to wear an armlet as being soldiers in the Reserve.

Harvest Labour.

THE following Circular Letter on Harvest Labour has been addressed by the Board to the Secretaries of War Agricultural Committees in England: Sir,—1. I am directed by the President of the Board of Agriculture and Fisheries to call attention to the desirability of making use this summer of all the available sources of auxiliary and holiday labour both for the harvest and for other seasonal work.

2. Since the commencement of the War the Board have received a considerable number of offers of such assistance both from individuals and from organised bodies, and Lord Selborne is satisfied that there is a large reservoir of labour available for work of the kind if it is properly organised and made use of.

3. An enquiry was conducted last year through the Labour Exchanges in order to ascertain the extent of the demand by farmers for auxiliary and holiday labour, and some 25,000 forms of enquiry were issued to farmers in many counties. Only about 1,300 of these forms were returned and the total demand was for less than 800 men and boys. In view of the very small demand it was useless to pursue the matter further, but the shortage of labour on the farms is now so much more serious than it was last year, and is likely to increase, that Lord Selborne thinks that the War Agricultural Committees should take steps at once to ascertain the probable demand for extra labour for harvest, &c., and to ascertain what the prospects are of meeting the demand.

4. Lord Selborne suggests, therefore, that your Committee should make enquiries through the District Committees or otherwise as to the extent of the demand, and I am to enclose for their consideration copies of a form of enquiry* which might be issued to the farmers of your county. Further copies of this form will be supplied on application to the Board. I am to add that Lord Selborne thinks that it would be desirable to send a covering letter signed by the Chairman of the Committee impressing upon farmers the urgent importance of seeing that there shall be no failure to secure the harvest through lack of labour, and that consequently it is their duty to make up the deficiency in their normal supply of labour by using that from any other sources which may prove to be available.

5. Lord Selborne is satisfied that if it is shown that there is a real need of assistance and that farmers are prepared, in view of the national emergency, to make use of forms of labour to which they are unaccustomed in normal times, there will be a ready response from persons

*Not here printed.

willing to assist. In every county there are large numbers of men over military age or otherwise ineligible for the Army who would be prepared to volunteer for work on the land during part of their holidays or in their leisure time, if they could be put into touch with farmers in need of help, and it is probable that assistance could also be obtained from the masters and boys of the public and secondary schools and from such bodies as the Boy Scouts' Association, the National Union of Teachers, the National Schoolmasters' Association, Officers' Training Corps, the Architectural Association and Industrial Co-operative Societies. Several of these bodies offered the services of their members to the Board last year, and the Cavendish Association, of 19-23, Oxford Street, London, W., has already approached the Headmasters of the principal Public Schools in the hope that they will co-operate in any scheme for enabling the boys and masters to assist in harvest work.

6. As soon as the probable extent of the demand by farmers has been ascertained the War Agricultural Committees should take steps to mobilise the available supply of labour and place it in touch with the farmers. For this purpose it is most desirable to make use of the resources and machinery of the Labour Exchanges, and I am to suggest that the Divisional Officer of the Labour Exchanges Department should be invited to attend any meetings of the Committee at which the matter is discussed. In the County of Cheshire arrangements have already been made to make local registers of those persons who are willing to assist in harvest work, and Lord Selborne feels sure that such men as the country clergy and ministers of all denominations, or the village schoolmasters, would be willing to act as registrars and to put farmers in touch with those persons who register their names.

7. I am to add that Lord Selborne attaches great importance to the necessity for the payment of adequate wages to any persons who undertake auxiliary or holiday labour on the land. There must be no ground for complaint that any farmers are taking advantage of patriotic offers of assistance to the detriment of persons of the labouring classes.

I am, &c.,
SYDNEY OLIVIER, *Secretary.*

THE following Leaflets have been issued in the ordinary series since the date of the list contained on p. 1020 of the *Journal* for January, 1916:—

Leaflets in 1916. No. 303.—*The Turnip Gall Weevil.*
No. 306.—*The Goat as a Source of Milk.*

In addition, the information in the following Leaflets has been revised and brought up to date:—

No. 10.—*Wireworms.* This Leaflet has been re-written.
No. 70.—*The Treatment of Neglected Orchards.* The section dealing with "Washes" has been re-written.
No. 80.—*Use of Artificial Manures.*
No. 84.—*House Sparrow.*
No. 105.—*Wart Disease (Black Scab) of Potatoes.*
No. 112.—*Weeds and their Suppression.*
No. 162.—*Grafting Fruit Trees.*
No. 170.—*The Use of Lime in Agriculture.* Notes on some sources of waste lime have been added.
No. 173.—*Potato Growing.*

No. 254.—*The Use of Seaweed as Manure.* The section dealing with the species of seaweed has been re-written.

No. 265.—*Utility Rabbit Breeding for Small Holders.*

No. 275.—*Improvement of Poor Hill Pasture.*

No. 279.—*Technical Advice for Farmers.* (Formerly Special Leaflet No. 25.)

No. 280.—*Sainfoin.*

No. 288.—*The Cultivation and Collection of Medicinal Plants in England* This leaflet has been extensively revised in the light of experience gained during the past year.

No. 296.—*Potato Growing in Allotments and Small Gardens.* (Formerly Special Leaflet No. 18.)

No. 298.—*Pig-keeping for Cottagers and Small Holders.* (Formerly Special Leaflet No. 10.)

A revision of the Welsh translation of Leaflet No. 114 (*Feeding of Poultry*) has also been issued.

A number of Special Leaflets have been issued since the date of the last list. The numbers and titles are as follows :—

Special Leaflet No. 51.—*Suggestions for the Manuring of Grass Land.*
" " 52.—*Destruction of Farm Vermin.*
" " 53.—*Sorghum for Fodder.*
" " 54.—*The Rearing of Chickens.*
" " 55.—*How to Increase the Production of Food during the War (Welsh Agricultural Council).*
" " 56.—*The Manuring of Cottage Gardens and Allotments.*
" " 57.—*The Use of Sulphate of Ammonia as Manure.*
" " 58.—*White Mustard.*
" " 59.—*Successful Employment of Women on the Land.*
" " 61.—*Transport of Agricultural Requisites and Produce.*

The following Special Leaflets have been revised and brought up to date :—

Special Leaflet No. 2.—*Notes on Poultry Feeding.*
" " 3.—*Poultry in Allotments and Garden Plots.*
" " 16.—*Notes on Pig Feeding.*
" " 17.—*Supplies of Pit Timber.*
" " 23.—*The Manuring of Corn in the Spring of* 1916. This leaflet has been entirely re-written with a view to meeting the conditions obtaining during the present season.
" " 24.—*Seed Testing.*
" " 26.—*Suggestions to Allotment Holders for General Cropping during the Spring and Summer Months.*
" " 32.—*War Food Societies.*
" " 33.—*Suggestions for Increasing the Egg Supply.*
" " 37.—*Economy in Food : Appeal to Country People.*

THE following Memorandum on the Custody of Inclosure Awards, dated March, 1916, has been issued by the Board :—

Memorandum as to the Custody of Inclosure Awards.

1. Enquiries are frequently addressed to the Board for information as to the whereabouts of Awards under Inclosure Acts passed prior to the General Inclosure Act of 1845.

2. All Awards under the Act of 1845 are in the custody of the Board, and copies thereof were deposited with the Clerk of the Peace for the County concerned, and also with the Churchwardens of the parish to be kept with the public papers of the parish. These latter have in many cases passed into the possession of the parish council. A list of all such Awards made up to the year 1893 is contained in a House of Commons Return (455 of 1893). Awards made under Acts passed between the General Inclosure Act, 1801, and the Inclosure Act, 1845, were in the absence of other provision in the authorising Act, to be enrolled in one of His Majesty's Courts of Record at Westminster, or with the Clerk of the Peace for the County; enquiries as to their present place of deposit and as to opportunity of inspecting them may be addressed to the Public Record Office, Chancery Lane, London, W.C. The place of deposit of Awards made under Acts prior to, or not governed by, the General Inclosure Act, 1801, can be discovered only by an examination of the provisions of each Act. In many cases these private Acts were not printed, and it would probably be difficult to discover any existing copy of the Act. A House of Commons Return (399 of 1914) contains a list of Inclosure Acts to the year 1914 inclusive, arranged under English and Welsh counties in alphabetical order, and distinguishing—where possible—the parishes affected. Lists of local Inclosure Acts from 1727 to 1834 are contained in George Bramwell's Analytical Table of Private Statutes (2 Vols., London: 1813 and 1835). Reference to the Index of Local Acts, 1801-1899 (H.M. Stationery Office: 1900) may also be useful in an endeavour to trace information.

3. It will be seen that considerable difficulty may be experienced in ascertaining the present location of Awards of Inclosure bearing a date prior to 1845. Many of them are included in the House of Commons Return (No. 30 of 1904) of Inclosure Awards deposited with Clerks of the Peace or Clerks of county councils, who may possibly in certain cases be in a position to supplement the information contained in that Return. Where this source of information fails, the Board may sometimes be able to furnish the name of the present custodian by reference to the Ordnance Survey Department, who have consulted very many Inclosure Awards in connection with the ascertainment of parochial boundaries. Information may also be available in some cases from the steward of the manor or from the parish council or incumbent of the parish concerned, or from diocesan registrars or chapter clerks.

4. A certain number of Inclosure Awards, or copies thereof, are in the custody of the Public Record Office, the Duchy of Lancaster Office, His Majesty's Commissioners of Woods and Forests and the Ecclesiastical Commissioners. At the Public Record Office are kept those Awards which were transferred from the Royal Courts of Justice, as well as those transferred with the Land Revenue Records from the Office of Woods and Forests. The Commissioners of Woods and Forests have information only as to the whereabouts of such Awards as affect Crown property.

5. A very few Awards relating to lands in Middlesex are in the keeping of the Land Registry, Lincoln's Inn Fields, London, W.C., as successors to the Middlesex Registry of Deeds; and many relating to lands in Yorkshire (East, North, and West Ridings) are at the Registries of Deeds at Beverley, Northallerton, and Wakefield respectively. There is reason to believe that some Inclosure Awards have found their way into private hands, while a small number are understood to be included in the collections of Manuscripts at the British Museum.

6. Persons interested in lands affected by an Inclosure Award have in most cases a statutory right to inspect the Award or deposited copies on payment of a fixed fee.

7. Where an Award or a deposited copy has got out of the proper custody, the provisions of the Inclosure Act, 1833, or of section 17 of the Local Government Act, 1894, may be found useful in securing its restoration to public custody.

Celery Leaf Spot Disease: Examination of Seed.

THERE seems little doubt that the spread of this disease has been due to the use of infected seed, so that the employment of disease-free seed would appear to be a most effective means of combating the pest.

The Board have made arrangements for the examination of celery seed for leaf-spot disease on the same lines as those adopted by the Department of Agriculture and Technical Instruction for Ireland. Samples should be forwarded to the Secretary, Board of Agriculture and Fisheries, Horticulture Branch, Craven House, Northumberland Avenue, London, W.C. A fee of 1s. per sample will be charged.

Celery Leaf Spot is dealt with in the Board's Leaflet No. 238, and in Leaflet No. 5 issued by the Department of Agriculture and Technical Instruction for Ireland.

Demonstrations of Women's Work.

THE following Circular Letter, dated 8th May, 1916, has been addressed by the Board to the Secretaries of War Agricultural Committees: Sir,—I am directed by the President of the Board of Agriculture and Fisheries to say that he has received reports of demonstrations* of women's work on the land which have been arranged at certain centres, and that he thinks that such demonstrations serve a useful purpose in showing farmers that women are capable of performing satisfactorily many forms of farm work.

Lord Selborne suggests for consideration that a demonstration of the kind might be arranged in your county, if this has not already been done, and that it might take place on some date during the week beginning 5th June, so there may be simultaneous demonstrations throughout the country.

The arrangements for the demonstration might be entrusted to a small joint committee of the War Agricultural Committee and the Women's Farm Labour Committee and it should include one or two farmers who have employed women with satisfactory results. The Commissioners of the Board of Agriculture and the Agricultural Organising Officers of the Board of Trade have been instructed to co-operate with you in making the necessary arrangements.

I am to add that particulars of successful demonstrations which have recently been held can be obtained from Mr. R. N. Dowling, Agricultural Organiser for Lindsey, 286, High Street, Lincoln, or from Mr. W. Borlase. Agricultural Organiser for Cornwall, County Offices, Truro.

I am, etc.,

SYDNEY OLIVIER. *Secretary*.

Cultivation of Common Fields.

LORD SELBORNE desires to call the attention of occupiers of commonable arable fields to the facilities afforded by the Inclosure Act, 1773, for the improvement of the method of cultivation of such lands.

Where the existing regulations as to cultivation are inconvenient, they can be altered under the Act without destroying the commonable character of the land.

Persons interested in such arable fields can obtain full details of the procedure on application in writing to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Land Settlement for Returned Soldiers in South Australia.—Provisions have been made in South Australia by the "Returned Soldiers Settlement Act, 1915," for the settlement on the land of discharged Australian soldiers and sailors who have served outside the Commonwealth in the present war.

The Act empowers the Governor of South Australia to set apart Crown land for the purpose, and this land will be sub-divided by the Land Board into "blocks," and offered to discharged soldiers on perpetual lease or on leases for terms of years.

In considering applications the Land Board is to take into consideration, either with or without special application, the advisability of assisting applicants with respect to (*a*) the clearing, fencing, draining, irrigating, and general improvement of lands leased; (*b*) the erection of buildings; (*c*) the purchase of implements, stock, seeds, plants, trees, etc. Money so advanced or expended is to bear interest and to be secured by a first mortgage, although in cases of hardship the payment of interest may be wholly or partly dispensed with. Rent may similarly be wholly or partly remitted or postponed.

Buenos Aires International Live Stock Show.—An International Live Stock Show will be held under the auspices of the Argentine Rural Society at Palermo, Buenos Aires, from the 15th to 22nd August next. Copies of the Regulations and entry forms may be obtained on application to the Consul-General for Argentina, 601, Salisbury House, Finsbury Circus, London, E.C.

Importation of Live Stock into the United States.—The Board are informed that ruminants and swine may now be imported into the United States from the United Kingdom. The exportation of these animals from the United Kingdom is prohibited (except to British Possessions) by Order in Council, but applications for licences to export may be made to the War Trade Department, 4, Central Buildings, Westminster, S.W.

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for April, 1916, issued by the International Institute of Agriculture, contains information regarding the sowing of winter cereals in the Northern Hemisphere. The areas estimated to have been sown with winter *wheat* in 1915–16, compared with the areas sown during the corresponding period of 1914–15, expressed as percentages, are as follows: Denmark 100, France 91, England and Wales 94, Rumania 101, Switzerland 107, Canada 85, United States 89, British India 94, Japan 111; with *rye*: Denmark 100, France 89, Rumania 116, Switzerland 105, United States 97; with *barley*: France 67, Rumania 92, Switzerland 103, Japan 96; with *oats*: France 88. The condition of autumn sown crops is good in Italy, Rumania, and Egypt, and satisfactory, on the whole, in France, Switzerland, United States, British India, Japan, and Algeria.

In the Southern Hemisphere the production of *maize* in Argentina is estimated at 18,794,000 qr. in 1915–16, against 39,450,000 qr. in 1914–15, or a decrease of 52·4 per cent., while the area sown showed a reduction of 4·4 per cent. In Hungary, Spain, Italy, Rumania, Russia in Europe, Switzerland, Canada, United States, Japan, Russia in Asia, and Argentina, the total yield of maize, which may be taken to approximate to the world's production, is placed at 434,721,000 qr. in 1915–16, against 411,380,000 qr. in 1914–15, an increase of 5·7 per cent.

As a supplement to the March number of the *Bulletin of Agricultural and Commercial Statistics* the International Institute of Agriculture has published a brochure entitled "Statistical Notes on the Yield, Consumption, and Prices of Cereals, with Rates of Ocean Freight." The products considered in this work are wheat, rye, barley, oats, maize, and rice. For each of them the world's yield in the crop-year 1915 (Northern Hemisphere) and 1915–16 (Southern Hemisphere) is given, together with that of the previous year (1914 in the Northern Hemisphere and 1914–15 in the Southern Hemisphere). By way of comparison the five years' averages (crop-years 1909 and 1909–10 to 1913 and 1913–14) are added. In these tables a percentage comparison has also been instituted between the crops of 1915 and 1915–16 and those immediately preceding, as well as with the results of the five-years' average.

Regarding *wheat*, in countries for which there are data either official or calculable (altogether representing 94 per cent of the total world's yield) the production of the crop-year 1915 and 1915–16 is estimated at 533,000,000 qr. The harvest is superior to that of the previous year in the same countries by 19·0 per cent., and to the average crop of the 5 years by 16·4 per cent. It is estimated that the probable requirements for the current year are 468,000,000 qr., against an available yield of 533,000,000 qr., which leaves a surplus of 65,000,000 qr. to meet the possible increase in consumption in the countries under review and in a large number of tropical countries and colonies, with estimated requirements of about 12,000,000 qr.

As a summary, the Institute gives the following conclusions:—The latest world's yield gives, as regards wheat, oats, and maize respectively, more or less of a surplus over and above the requirements, but these surplus yields have to supply the needs of countries not taken into account but importing flour to some considerable extent. Such are mostly the inter-tropical countries and colonies. There is a small deficiency in rye, and one of some little importance in barley, but there should be no difficulty in making good these deficiencies from other

stocks carried over to the present season, but disregarding such products as may supplement or replace cereals, or vice versa, the world taken as a whole has a sufficiency of cereals to satisfy requirements of consumption generally speaking, on the basis of the average consumption of the five years under review.

France.—According to a report issued by the Minister of Agriculture, the condition of the crops on the 1st April was as follows:—winter wheat, 69; rye, 70; winter barley, 71; winter oats, 70; and hay, 76 to 78. (100 = very good, 80 = good, 60 = fairly good.) (*The London Grain, Seed and Oil Reporter*, 26th April.)

Italy.—The Official Report for the period 1st–10th April states that the crops are generally satisfactory. Cereals and pulse promise good crops, and the strong appearance of forage plants justifies the hope of an abundant yield. (*Broomhall's Corn Trade News*, 24th April.)

Canada.—The High Commissioner for Canada, in a report dated 14th April, states that seeding operations were general at that date in northern and southern Alberta. Conditions were ideal and there is expected to be nearly as large an acreage in Alberta as last year. Ploughing and early seeding were also well under way in Brandon district, Manitoba.

United States.—The Crop Reporting Board of the Department of Agriculture estimates that the area of winter wheat to be harvested is about 33,020,000 acres, as compared with 40,453,000 acres harvested last year. The average condition of this crop on 1st May was 82·4, against 92·9 last year, and 87·5 the average of the past ten years, and the total production is estimated at 499,000,000 bush. The average condition of rye on 1st May was 88·7, against 89·8 last year and 89·1 the average of the past ten years. 70·4 per cent. of the spring ploughing was completed by 1st May, against 78·3 per cent. last year, and 70·9 per cent. in 1914, whilst 56·7 per cent. of spring corn sowing was done, against 65·3 per cent. last year and 56·4 per cent. in 1914. (*The London Grain, Seed, and Oil Reporter*, 8th May.)

India.—According to a Special Government Forecast the acreage of wheat in India this season is 30,100,000 acres, and a yield of 8,490,000 tons is expected, as compared with 32,230,000 acres and 10,269,000 tons in the previous season. (*The London Grain, Seed and Oil Reporter*, 22nd April.)

Agricultural Conditions in England and Wales on 1st May.

THE crop reporters of the Board, in commenting on agricultural conditions in England and Wales, report that the weather of April, although cold for most of the time, was generally favourable to agriculture, especially the last few days. All wheat improved during the month, and that on the lighter lands generally looks well; wheat on low-lying or heavy land, and that which was sown late, is, however, poor generally. Much progress was made with the sowing of spring corn, although a considerable area still remains to be sown. Owing to the backward season, and consequent pressure of arrears, there is generally a poor seed-bed (except in the north); nevertheless, the young barley and oats, where showing, appear to be a full plant and satisfactory. Beans are generally doing well, and appear to be the best of the corn crops in some districts.

Potato planting is very behindhand; it is now in full swing in the most important counties, but the bulk of this work was only begun

be planted. Practically no mangolds have been sown yet, and in many cases preparation of the land has not yet been done for this crop, owing to the lateness of the corn-sowing season.

Fruit trees everywhere show abundance of blossom, but they are very late.

Root crops grown for seed in the eastern counties are not very promising, especially turnips. It is expected that the area under mustard will be largely increased this year.

Clover and rotation grasses are everywhere satisfactory, more especially in the east, they are healthy and vigorous, and a good crop of seeds' hay is looked for. Pastures were in many districts bare, and late in starting growth, but the favourable conditions at the end of the month effected a great improvement, and they are now sufficiently promising, although some districts are more backward than others. Live stock in many localities were, owing to scarcity of keep, turned out earlier than usual; their condition is, upon the whole, only moderate, and they did not make much progress during the month.

Hill flocks have yielded nearly an average crop of lambs, but have hardly done so well as lowland districts; still, on the whole, the fall of lambs has generally been a good one. Losses among ewes or lambs have been, however, fairly heavy in many districts, largely as a result of the severe storms at the end of March. At the end of April lambs were generally doing well.

Agricultural Labour in England and Wales during April.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st May, labour was very scarce, especially in the case of casual workers, and the deficiency was probably all the more felt owing to the arrears of a late season. In many districts women, and also children, rendered help, especially in potato planting.

The following summaries give details regarding the different districts:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour was very deficient; casual workers for potato planting were difficult to obtain.

Lancashire and Cheshire.—The outlook for labour was bad, but female labour was obtainable to a small extent for potato planting in south-west Lancashire.

Yorkshire.—The supply was very deficient and fears were expressed that many root crops would not be got in at all. A few women were available for potato planting locally, but casual labour generally was hardly obtainable.

Shropshire and Stafford.—Labour continued to be very scarce, casual labour being unobtainable.

Derby, Nottingham, Leicester, and Rutland.—Labour was very short everywhere; women and children were helping to relieve the strain.

Lincoln and Norfolk.—All classes of labour were very scarce, and the deficiency contributed to the backward state of cultivation. Women were being employed in many parts of both Lincoln and Norfolk for potato planting.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was very deficient, and wages were increased in many districts. In Cambridgeshire many women were planting potatoes, but the scarcity of horsemen was being especially felt.

Bedford, Northampton, and Warwick.—Farm workers were very

Buckingham, Oxford, and Berkshire.—Labour was deficient in all parts of the district. No casual labour was available, but the employment of women and children for potato planting was reported from parts of Oxfordshire and Berkshire.

Worcester, Hereford, and Gloucester.—Farmers felt the shortage in the supply of labour, and found it difficult to keep the work going as quickly as it ought. More women were being employed with success.

Cornwall, Devon, and Somerset.—The supply of labour showed no improvement. Casual labour was unobtainable, but in one or two districts the employment of women was reported.

Dorset, Wiltshire, and Hampshire.—Farmers were working with very short staffs, and casual labour was very difficult to obtain. Some help was being obtained from women and children.

Surrey, Kent, and Sussex.—Labour was short, and the scarcity was increased, or at least more felt during the past busy month. Wages were higher than last year.

Essex, Hertford, and Middlesex.—Labour was generally very scarce and farmers will have difficulty in getting the work done satisfactorily.

North Wales.—There was a great deficiency of labour throughout the division, and casual labour especially was very scarce.

Mid Wales.—Farmers were very short of men, and there was very little casual labour.

South Wales.—The shortage, especially of casual labour, continued, and was being severely felt in most districts.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st May, 1916, certain diseases of animals existed in the countries specified :—

Austria (on the 5th April). — Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of Feb.).—Anthrax, Foot-and-Mouth Disease (118 outbreaks), Swine Erysipelas, Swine Fever.

France (for the period 2nd—15th April).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—31st March).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of March).—Anthrax, Foot-and-Mouth Disease (21 outbreaks) Foot-rot, Swine Erysipelas.

Hungary (on the 5th April).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 3rd—9th April).—Anthrax, Blackleg, Foot-and-Mouth Disease (1,121 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of March).—Anthrax, Blackleg.

Rumania (for the period 29th Feb.—7th March).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of Nov.).—Anthrax, Foot-and-Mouth Disease (93,669 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of Jan.).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of March).—Anthrax, Blackleg, Foot-and-Mouth Disease (1 outbreak).

Switzerland (for the period 10th—16th April).—Anthrax, Blackleg, Foot-and-Mouth Disease (8 "étables" entailing 160 animals, of which 4 "étables" were declared infected during the period), Glanders, Swine Fever.

No further returns have been received in respect of the following countries:—Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during April.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.		Rainfall. Diff. from Average.	No. of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending April 1st:								
England, N.E. ...	41·2	−0·6	0·35	9	−1	2	5·7	+1·0
England, E.	40·9	−2·0	1·16	29	+20	3	5·2	+0·4
Midland Counties ...	40·7	−2·0	0·91	23	+13	3	4·5	+0·2
England, S.E. ...	41·4	−2·7	1·03	26	+17	3	4·9	+0·2
England, N.W. ...	41·2	−1·5	0·12	3	−11	2	4·2	−0·1
England, S.W. ...	41·2	−3·1	1·15	29	+14	4	4·5	−0·3
English Channel ...	43·6	−3·1	1·12	28	+16	4	4·8	−0·8
Week ending April 8th:								
England, N.E. ...	42·7	+0·2	0·18	5	−5	3	6·9	+1·8
England, E.	43·2	−0·8	0·36	9	0	3	6·8	+1·7
Midland Counties ...	43·2	−0·8	0·05	1	−9	1	6·9	+2·2
England, S.E. ...	44·5	−0·8	0·16	4	−4	1	7·6	+2·6
England, N.W. ...	42·7	−1·1	0·10	3	−10	2	6·6	+2·4
England, S.W. ...	43·4	−2·0	0·05	1	−13	1	7·8	+2·7
English Channel ...	46·3	−1·5	0·08	2	−9	2	8·6	+2·6
Week ending April 15th:								
England, N.E. ...	45·4	+2·0	0·21	5	−4	3	7·3	+2·3
England, E.	45·2	+0·6	0·47	12	+3	4	6·9	+1·8
Midland Counties ...	45·4	+0·8	0·34	9	−1	5	7·2	+2·5
England, S.E. ...	46·1	0·0	0·31	8	0	5	7·0	+1·9
England, N.W. ...	44·8	+0·2	0·93	24	+12	6	6·0	+1·3
England, S.W. ...	45·9	−0·2	0·57	15	+2	5	8·2	+2·9
English Channel ...	48·1	−0·2	0·21	5	−6	4	8·4	+2·2
Week ending Apr. 22nd:								
England, N.E. ...	43·7	−0·7	0·96	24	+15	6	1·5	−3·5
England, E.	44·8	−1·1	0·67	17	+8	5	2·1	−3·2
Midland Counties ...	44·1	−1·8	0·75	19	+9	6	1·8	−3·0
England, S.E. ...	45·4	−1·6	0·64	16	+6	6	2·6	−2·8
England, N.W. ...	44·3	−1·6	1·33	34	+23	6	2·7	−2·4
England, S.W. ...	45·0	−2·0	0·77	20	+6	5	4·4	−1·1
English Channel ...	46·8	−2·2	0·41	10	−2	4	5·5	−0·8
Week ending April 29th:								
England, N.E. ..	50·6	+4·7	0·05	1	−8	2	5·0	−0·2
England, E.	52·6	+5·4	0·04	1	−9	1	8·7	+3·1
Midland Counties ...	52·2	+4·9	0·08	2	−9	2	6·3	+1·2
England, S.E.... ...	53·8	+5·4	0·02	1	−11	1	9·0	+3·3
England, N.W. ...	51·5	+4·4	0·22	5	−8	1	5·6	+0·4
England, S.W. ...	52·2	+4·2	0·23	6	−10	2	7·1	+1·4
English Channel ...	53·3	+3·5	0·03	1	−12	1	8·3	+1·6

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	72	77	240	285
Animals attacked	88	89	281	317
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	2	4	21	11
Animals attacked	4	5	62	16
Parasitic Mange:—				
Outbreaks	223	223	1,234	*223
Animals attacked	427	526	2,939	*526
Sheep-Scab:—				
Outbreaks	18	10	167	144
Swine Fever:—				
Outbreaks	568	445	1,646	1,392
Swine Slaughtered as diseased or exposed to infection	1,761	2,121	5,137	6,089

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH. †	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	1	1	1
Animals attacked	—	1	5	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	4	3	22	13
Sheep-Scab:—				
Outbreaks	30	44	172	175
Swine Fever:—				
Outbreaks	23	26	59	65
Swine Slaughtered as diseased or exposed to infection	189	159	294	407

† Owing to delay in receipt of the returns, last month's figures have been repeated.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in April and March, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	April.		March.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	13 10	12 10	12 1	11 8
Herefords	13 6	12 7	12 6	11 4
Shorthorns	13 6	12 6	12 1	11 2
Devons	13 5	12 0	12 1	10 11
Welsh Runts	12 11	12 3	11 10	11 2
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	12½	11¼	10½	9¼
Sheep:—				
Downs	14	12¾	13¼	12¼
Longwools	12½	11½	12½	11¼
Cheviots	14¼	12¾	14¼	12¾
Blackfaced	14	12½	14	12¼
Welsh	14	12¼	12¾	11½
Cross-breds	13¾	12½	13½	12¼
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 7	11 10	11 11	11 2
Porkers	13 2	12 6	12 10	12 1
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	31 7	24 19	29 19	24 3
,, —Calvers ...	30 1	23 12	29 1	23 7
Other Breeds—In Milk ...	27 19	24 0	25 19	22 4
,, —Calvers ...	20 0	18 10	22 10	19 0
Calves for Rearing	2 19	2 5	2 16	2 3
Store Cattle:—				
Shorthorns—Yearlings ...	13 19	11 19	13 10	11 11
,, —Two-year-olds...	19 12	17 0	18 9	16 6
,, —*Three-year-olds*	25 17	21 17	24 16	20 7
Herefords —Two-year-olds...	24 2	21 0	20 14	17 11
Devons— ,,	23 5	18 9	20 5	17 1
Welsh Runts— ,,	18 19	16 7	18 6	16 1
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	68 1	58 9	65 5	54 9
Store Pigs:—				
8 to 12 weeks old	31 8	24 8	28 9	22 5
12 to 16 weeks old	49 1	38 4	45 11	35 8

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in April, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF:—											
English	1st	93	6	90	0	—		92	0	90	6
	2nd	89	0	85	0	—		88	6	87	6
Cow and Bull	1st	85	0	82	0	80	0	79	6	82	0
	2nd	78	6	77	6	66	6	74	6	77	0
Irish: Port Killed	1st	91	0	—		89	0	90	0	87	6
	2nd	88	6	—		84	6	87	0	84	6
Argentine Frozen—											
Hind Quarters	1st	80	0	—		74	6	80	0	74	6
Fore ,, ...	1st	74	6	—		65	6	78	0	65	6
Argentine Chilled—											
Hind Quarters	1st	89	0	88	0	85	0	89	0	86	6
Fore ,, ...	1st	75	0	73	6	74	0	74	0	74	0
Australian Frozen—											
Hind Quarters	1st	68	6	—		73	0	—		78	6
Fore ,, ...	1st	60	6	—		62	6	—		63	0
VEAL:—											
British	1st	130	6	112	0	—		119	0	—	
	2nd	102	6	93	6	90	0	104	0	88	6
Foreign...	1st	—		—		—		—		—	
MUTTON:—											
Scotch	1st	119	0	108	0	129	6	116	0	127	0
	2nd	110	6	101	6	118	0	108	6	120	0
English...	1st	119	0	108	6	—		109	6	114	6
	2nd	111	0	102	0	—		103	0	105	0
Irish: Port Killed	1st	116	6	—		112	0	—		107	6
	2nd	107	6	—		107	6	—		100	6
Argentine Frozen	1st	92	0	90	6	88	6	90	0	88	6
Australian ,, ...	1st	87	6	91	0	82	6	78	6	79	6
New Zealand ,, ...	1st	—		90	0	—		78	6	—	
LAMB:—											
British	1st	136	6	149	6	135	6	129	6	130	6
	2nd	122	6	140	0	121	6	120	0	114	6
New Zealand	1st	95	0	95	0	92	0	88	6	92	6
Australian	1st	95	0	94	0	89	0	87	0	89	0
Argentine	1st	95	0	94	0	91	6	97	0	91	6
PORK:—											
British	1st	110	0	102	6	103	0	105	6	101	6
	2nd	106	0	99	0	93	6	98	6	94	6
Frozen	1st	87	6	87	6	84	6	90	0	85	6

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in April, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL. First Quality.	BRISTOL. Second Quality.	LIVERPOOL. First Quality.	LIVERPOOL. Second Quality.	LONDON. First Quality.	LONDON. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	20 0	19 0	—	—	18 0	17 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	160 0	158 0	161 0	158 0	161 6	158 0
,, Factory	140 0	130 0	139 0	129 0	142 0	132 0
Danish...	—	—	173 6	170 6	174 6	172 6
French...	—	—	—	—	160 0	154 0
Russian	128 6	116 6	—	125 0	134 0	126 0
Canadian...	—	—	—	—	—	—
Australian	160 0	156 0	158 0	156 0	160 6	156 6
New Zealand	167 0	164 6	166 6	164 6	164 0	162 0
Argentine	158 0	154 0	158 6	155 6	158 0	154 0
CHEESE :—						
British—						
Cheddar	114 0	110 0	114 0	111 6	115 6	111 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	121 6	116 0	128 6	122 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	107 6	104 0	106 0	103 6	108 6	106 6
BACON :—						
Irish (Green)	113 0	108 0	112 0	109 0	111 0	108 6
Canadian (Green sides)	100 6	97 6	100 0	96 0	101 0	97 0
HAMS :—						
York (Dried or Smoked)	158 0	154 0	—	—	160 0	154 0
Irish (Dried or Smoked)	—	—	—	—	146 6	139 0
American (Green) (long cut)	90 6	87 0	90 6	87 6	91 0	89 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	13 6	—	—	—	15 2	14 2
Irish	14 1	—	14 6	13 7	14 9	14 0
Danish	—	—	—	—	19 6	17 4
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	136 0	125 6	121 6	115 0	157 6	147 6
Up-to-date	141 0	118 0	118 6	116 6	151 6	141 6
Other Late Varieties ...	146 0	123 6	—	—	155 0	145 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 8...	30	11	46	2	55	8	25	11	29	7	47	8	18	4	26	5	31	5
,, 15...	31	0	48	9	56	7	26	0	30	5	48	6	18	6	27	6	31	11
,, 22...	30	11	51	6	57	2	26	3	31	3	49	6	18	11	28	10	32	6
,, 29...	31	1	52	8	58	0	26	6	32	5	51	0	19	1	29	10	32	11
Feb. 5...	31	0	53	3	58	3	26	7	33	7	52	5	18	9	30	3	32	4
,, 12...	31	0	54	8	57	6	26	7	34	7	52	10	18	11	31	1	32	2
,, 19...	31	0	56	0	56	11	26	7	34	11	53	6	18	11	31	5	31	9
,, 26...	31	0	56	0	58	2	26	6	35	3	54	2	18	11	31	8	32	2
Mar. 4...	31	5	55	11	59	4	26	2	34	6	55	7	18	9	31	8	32	4
,, 11...	31	6	54	8	58	2	26	0	33	5	55	6	18	7	31	0	32	3
,, 18...	31	5	53	9	57	9	25	8	32	2	55	4	18	6	30	7	31	10
,, 25...	31	4	54	3	55	11	25	7	31	11	54	6	18	8	30	6	31	4
Apl. 1...	31	6	54	6	53	6	25	6	31	9	53	8	18	5	30	6	30	5
,, 8...	31	5	54	9	51	8	26	8	31	3	53	7	18	4	30	4	30	1
,, 15...	31	7	55	4	53	2	25	4	30	10	53	1	18	4	30	5	30	7
,, 22...	31	9	56	5	55	3	26	6	31	5	52	10	18	5	30	11	31	8
,, 29...	31	9	58	3	56	3	26	0	32	7	53	5	18	5	31	5	32	4
May 6...	32	2	60	5	55	7	25	6	33	3	53	1	18	9	32	4	32	10
,, 13...	32	7	61	7			26	3	34	0			18	11	32	5		
,, 20...	33	0	62	0			25	10	34	1			19	0	32	8		
,, 27...	33	9	61	11			26	1	34	8			19	4	32	7		
June 3...	34	0	61	9			25	11	35	4			19	4	32	5		
,, 10...	34	1	60	1			24	11	34	5			19	8	32	4		
,, 17...	34	1	56	1			25	10	34	3			19	9	31	9		
,, 24...	34	3	52	0			25	4	34	4			20	0	31	9		
July 1...	34	4	49	5			24	6	35	3			19	9	31	1		
,, 8...	34	2	50	1			24	9	34	7			20	0	31	6		
,, 15...	34	1	52	7			24	2	35	8			19	10	31	6		
,, 22...	34	0	53	10			24	7	35	10			19	9	32	1		
,, 29...	34	2	55	3			25	9	36	1			19	8	31	1		
Aug. 5...	34	9	55	4			25	2	35	7			19	1	31	5		
,, 12...	40	3	55	2			29	4	37	0			25	1	31	7		
,, 19...	38	9	54	3			29	10	39	4			24	3	31	4		
,, 26...	36	2	51	11			30	3	38	3			23	5	30	0		
Sept. 2...	36	5	45	3			30	6	38	1			23	9	26	10		
,, 9...	37	10	43	0			29	11	37	11			23	11	26	8		
,, 16...	38	3	42	9			29	5	39	0			23	8	26	4		
,, 23...	37	6	43	3			29	3	39	8			23	3	26	1		
,, 30...	37	1	43	5			29	1	40	4			22	9	26	5		
Oct. 7...	36	8	44	1			28	10	41	0			22	5	26	5		
,, 14...	36	7	45	9			28	8	42	3			22	4	27	1		
,, 21...	37	2	48	2			28	7	44	0			22	5	28	1		
,, 28...	37	10	50	3			28	3	46	2			23	7	29	1		
Nov. 4...	38	8	51	6			28	6	47	3			23	7	30	4		
,, 11...	39	8	52	8			29	0	47	5			24	8	30	11		
,, 18...	41	0	53	6			29	8	47	11			25	5	31	3		
,, 25...	41	11	54	2			30	3	48	7			25	8	31	1		
Dec. 2...	42	2	53	7			30	2	48	11			25	9	30	11		
,, 9...	42	1	52	10			29	11	47	10			25	9	30	4		
,, 16...	42	7	53	11			29	8	47	5			25	9	30	6		
,, 23...	43	3	53	10			29	9	47	2			25	11	30	7		
,, 30...	44	4	54	9			29	10	47	5			26	6	30	10		

NOTE.—Returns of purchases by weight or weighed measure are converted to

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of April, 1914, 1915, and 1916.

—	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	32	5	56	11	53	11	25	4	32	9	52	8	19	10	32	2	33	7
Norwich ...	31	3	54	7	53	4	25	2	30	5	51	2	17	10	30	6	31	3
Peterborough	31	0	55	8	53	7	26	0	30	3	51	7	18	6	30	11	31	6
Lincoln ...	31	11	56	5	55	5	25	9	30	10	54	3	18	10	30	8	31	5
Doncaster ...	31	5	54	11	53	1	25	5	30	0	54	8	18	5	29	3	30	0
Salisbury ...	30	6	53	8	53	5	23	10	31	11	50	10	17	11	31	7	30	9

ADDITIONS TO THE LIBRARY.

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MANURIAL VALUES OF CONCENTRATED FOODS IN RELATION TO COST OF FOOD IN THE PRODUCTION OF MILK.

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IN reports on the cost of food in the production of milk issued during recent years, the results arrived at have frequently been adversely criticised because no account had been taken of the residual manurial value of the foods consumed. In most instances, the writers of the reports in question recognised this defect, and in the third and fourth reports on the cost of food in the production of milk issued from the South Eastern Agricultural College, an attempt is made to place a value on the manurial residues. In these reports it is stated that if the manurial values of purchased foods were allowed for "it would "reduce the cost of the winter feeding of cows by about $1\frac{1}{4}d.$ "per day (equivalent to $\frac{1}{2}d.$ per gal. of milk) and the cost "of the summer feeding by about $\frac{2}{3}d.$ per day (equivalent to "$\frac{1}{4}d.$ per gal. of milk), or an average reduction of $1d.$ per day for "food throughout the year." As the yield of milk was found to average $2\frac{1}{4}$ gal. per day, this is equal to a reduction of $\frac{2}{5}d.$ per gal. No information is given as to how the above figures have been arrived at.

During the two years October, 1913, to September, 1915, the writer conducted an investigation into the cost of food in the production of milk on 39 farms in the counties of Berkshire and Buckingham, and, in addition to the information essential to the main object of the investigation, an attempt was made to work out the value of the manurial residues. The particulars necessary for this object as regards kinds and quantities of concentrated foods used during the year, including home-grown grain, were ascertained from the food record sheets kept at each farm, and the farmers themselves supplied information regarding the management of the manure. All the details required were

obtained for 37 farms in 1913-14 and 36 farms in 1914-15 out of the 39 farms visited each year.

Method of Estimating Manurial Values.—The method of estimation adopted was based on an article* by Messrs. Hall and Voelcker on "Compensation for the Unexhausted Manurial Values of Feeding Stuffs and Fertilisers." This article discusses fully the reasons for the revision of the scale of compensation published in 1902, and also contains valuable suggestions for the estimation of manurial values of foods fed to classes of stock and under conditions differing somewhat from those to which the scale of compensation definitely applies. The writer has adopted, as far as possible, Hall and Voelcker's suggestions with reference to the foodstuffs fed to milking-cows, using new methods of estimation only where these seemed necessary to meet the circumstances. Before discussing in detail the methods and results of the inquiry, it is desirable to summarise briefly the principles which form the basis of Hall and Voelcker's system for the valuation of unexhausted manurial residues.

Summary of Principles of Valuation.—The value of the manurial residue from any food depends on the quantities of nitrogen, phosphoric acid and potash which the food contains, but only a proportion of the total amounts of these substances becomes available for fertilising purposes. Allowance has to be made for the quantities retained in the body of the animal, and for those lost in the making of the dung under the ordinary conditions of farm practice; hence, it is estimated that only *one-half* (50 per cent.) of the nitrogen and *three-quarters* (75 per cent.) of the phosphoric acid and potash originally present in the food can be credited to the manure. The prices placed on the units of nitrogen, phosphoric acid and potash are 15*s.*, 3*s.* and 4*s.*, respectively, and, when the amounts of these substances in a food are known, it is easily possible to calculate the manurial value per ton. The amount of nitrogen, phosphoric acid, and potash retained in the body of the animal varies with its age and condition and the purpose for which the animal is kept; the loss of manurial ingredients from the dung varies greatly according to the methods of management and storage.

The table of manurial values, as set out by Hall and Voelcker, refers solely to the residues left when the cakes and meals have been fed to fattening cattle, and, as regards the making and storage of the manure, they expressly state that they "presume the manure to have been made in boxes or yards where there

* See *Journal of the R.A.S.E.*, 1913, pp. 104–119; also summarised in this *Journal* for January, 1915, p. 931.

is no avoidable loss by drainage, and where the manure is not washed by rain; further, that the manure has been made with all reasonable care, and that it has been stored, protected from the rain, and not unduly exposed or otherwise subjected to loss."

When the feeding stuffs are fed directly to the stock on the land, the losses due to the making and storage of manure are much reduced, and consequently a higher manurial value is allowed for the nitrogen—70 per cent. instead of 50 per cent. being estimated as available for the first crops following.

A table given in the article referred to shows the amount of nitrogen, phosphoric acid and potash in 31 feeding stuffs, with the values per ton of the manurial residues stated in 4 columns, the headings of which are given below:—

Column D—(1). Food made into dung—before one crop has been grown or removed.
,, D—(2). Food made into dung—after one crop has been grown or removed.
,, D—(3). Food consumed on land—before one crop has been grown or removed.
,, D—(4). Food consumed on land—after one crop has been grown or removed.

Methods for Food Fed to Milking-Cows.—Hall and Voelcker have not prepared a separate scale of value when foods are fed to cows in milk, but their opinion is given in the following quotation:—

"It is quite true that milking-cows excrete less of the nitrogen, phosphoric acid, etc., in their food than do fattening bullocks. They are, however, pastured to a greater degree upon the land, under which conditions they will return more than do bullocks which are fed in the yard; hence, in this case the value of their excreta would probably be represented by figures somewhat in excess of those in column D (1). On the other hand, while the cows are within doors, the proper amount of compensation would be less than that indicated in D (1). The circumstances of the case could only be met by the addition of another column to the tables, or, more probably, two fresh ones. Apart from the inconvenience of this, there would have to be taken into consideration what proportion of the time the cows were out at grass, and what time under cover. This would be very hard to arrive at, and so we have decided that it would be better to class these cases all together, and apply the figures of column D generally to foods consumed by milking-cows as well as by fattening bullocks. It would be open to the valuer to use his discretion, either as to allowing rather more when the cows were for the greater part of the year out at grass, or a somewhat less amount where the cows were kept in the stalls with little or no litter and where the urine to a large extent went to waste."

As it was not possible for the writer to obtain all the information which would be at the disposal of a valuer, nor to make

satisfactory personal examinations of the system of the management of the manure on each farm, it was decided to assume that the total *increase* in manurial value due to the cows being on pasture for a great part of each year would be balanced by the total *decrease* in manurial value due to the greater utilisation of nitrogen, phosphoric acid, etc., by the cows for milk production, and that the values in column D (1) could therefore be applied to cows, except for such deductions as might be necessary where the conditions of making and storage were inferior to those assumed by Hall and Voelcker.

The manurial values per ton as stated in Hall and Voelcker's column D (1) are reproduced here for only 22 of the 31 foods included in the original table, as the remaining 9, which comprised the various kinds of roots, straw, hay, and wet grains, were not considered in the present inquiry.

TABLE I.

*Values per Ton of Unexhausted Manurial Residues of various Foods, when made into Dung and applied before one Crop has been grown or removed. (Column D (1)).**

Food.	*Manurial Value per ton.* s.	d.	*Food.*	*Manurial Value per ton.* s.	d.
Decorticated Cotton Cake	64	9	Beans	36	4
Undecorticated Cotton Cake (Egyptian)	37	1	Peas	31	9
Undecorticated Cotton Cake (Bombay)	33	8	Wheat	17	0
Linseed Cake	44	4	Barley	15	8
Linseed	34	7	Oats	17	11
Soya Bean Cake	60	10	Maize	15	2
Palm Nut Kernel Cake	22	11	Rice Meal	16	9
Coconut Cake	34	7	Locust Beans	13	2
Ground Nut Cake	66	2	Malt	17	4
Rape Cake	40	11	Malt Culms	39	9
			Bran	31	3
			Brewers' Grains (dried)	29	0

Methods of Management and Feeding.—Fortunately, for the purposes of this inquiry, there was a great similarity on many important points between the farms for which particulars were obtained. As a rule, the cows were out of doors day and night from the end of April or the beginning of May until the month of November, and from November onwards throughout the winter they were turned out for a few hours in the middle of the day, and were indoors at night. On only two farms were the cows out of doors during both summer and winter.

The methods of feeding concentrated foods varied slightly from farm to farm. In some cases an allowance was given to the heaviest milkers throughout the summer, while in others no cakes or meals were fed from May to August. It has not been

* From *Journal R.A.S.E.*, 1913, pp. 114–115.

thought necessary to take account of this difference, as in every case by far the largest proportion of the year's supply was consumed during the winter, when the cows were indoors at night. The actual totals were, in 1913-1914, fully 660 tons fed from October to April, and fully 229 tons from May to September; during 1914-1915, fully 711 tons from October to April, and almost 195 tons from May to September. In other words, 75 per cent. of the cakes and meals were fed from October to April and 25 per cent. from May to September.

Different Kinds of Food Used.—On the 37 farms for which particulars were obtained in 1913-14, no fewer than 34 different kinds of concentrated foods, and 9 mixtures of home-grown grains were used, representing a total quantity of fully 889 tons. By far the larger proportion of this total consisted of the well-known foods given in the Table on p. 212, the actual quantity being almost 636 tons; some 63 tons consisted of maize by-products and other foods not given in the table, and the various proprietary dairy cakes and meals were represented by fully 190 tons.

On the 36 farms visited in 1914-1915, 40 different kinds of concentrated foods were used, representing a total of fully 906 tons. Of this total, 630 tons were foods given in Hall and Voelcker's table, 52 tons of maize and wheat by-products, and almost 225 tons of proprietary cakes and meals.

For the two years the total weight of food was 1,795 tons. The most popular foods were decorticated cotton cake and meal and Egyptian cotton cake, while others followed as stated below:—

Amounts of Various Foods used in Two Years.

Decorticated Cotton Cake and Meal..	338 tons	= 35 per cent. of the total quantity used.
Egyptian Cotton Cake	318 ,,	
Compound Dairy Cake and Meal (1)	124 ,,	No other food used to the extent of 50 tons.
Linseed Cake	120 ,,	
Dried Grains	100 ,,	
Compound Dairy Cake and Meal (2)	95 ,,	
Soya Cake and Meal	71 ,,	
Compound Dairy Cake and Meal (3)	61 ,,	
Oats	58 ,,	

Methods of Calculation for Special Foods.—It was necessary to calculate the manurial values for those foods which were not found in Hall and Voelcker's table. For home-grown grain mixtures, the proportion of each kind of grain was ascertained and the percentages of nitrogen, phosphoric acid and potash were calculated from the composition of the individual grains. For such foods as sharps, maize germ meal, and maize gluten feed the required percentages were obtained from Bulletin 73 of Leeds University, but for proprietary foods the percentage of nitrogen

was calculated from the albuminoids by dividing by 6·25 (the percentage of albuminoids was obtained either from the guaranteed composition or by analysis in the laboratory), and average figures were taken for the percentages of phosphoric acid and potash after considering the percentages of these two substances usually found in the materials most largely used in the manufacture of compound foods. In one or two special cases, additional information made it desirable to depart from these averages. When the amounts of the three manurial ingredients were arrived at, the manurial value per ton was calculated from the unit values used by Hall and Voelcker. The following example will illustrate the method adopted in the case of a proprietary food:—

A consignment of a well-known dairy cake was guaranteed to contain 18 per cent. albuminoids and 8 per cent. oil.

18 per cent. albuminoids ÷ 6·25 = 2·88 per cent. nitrogen. Average for phosphoric acid = 1·75 per cent., and for potash = 1·0 per cent.

	s.	d.
Nitrogen, 2·88 per cent. × 15*s.* = 43*s.* 2*d.* Half to manure =	21	7
Phosphoric acid, 1·75 per cent. × 3*s.* = 5*s.* 3*d.* Three-quarters to manure =	4	0
Potash, 1·0 per cent. × 4*s.* = 4*s.* ,, ,, =	3	0
Estimated manurial value per ton =	28	7

The manurial value of 14 proprietary foods ranged from 27*s.* 8*d.* to 57*s.* per ton.

Statement for Individual Farms.—When the manurial value per ton of each food had been arrived at, the gross value of the manurial residues for each farm for the 12 months was worked out thus:—

FARM A.

Food.	*Quantity Used.* t. c. lb.	*Manurial Value per ton.* s. d.	*Gross Manurial Value.* £ s. d.
Soya Bean Cake	0 18 0	60 10	2 14 9
Egyptian Cotton Cake ..	8 13 84	37 1	16 2 2
Dec. Cotton Meal.. ..	12 15 0	64 9	41 5 7
Maize Germ Meal.. ..	12 0 28	20 7	12 7 3
Linseed Cake	0 14 28	44 4	1 11 7
Compound Dairy Cake ..	4 17 28	31 7	7 13 7
Bombay Cotton Cake ..	2 8 8	33 8	4 0 11
			£85 15 10

Deductions from Gross Manurial Value on Account of Conditions of Making and Storage.—In discussing this subject, Hall and Voelcker comment on the unavoidable loss which has been found to occur even under the best conditions of making and storage, and they make the statement quoted on pp. 210-211, describing the conditions to which the values in their table apply.

Under bad conditions a greater loss will occur, and this must be assessed by the valuer at his own discretion, but Hall and Voelcker add the following paragraph:—

> "But seeing that manure, be it ever so badly kept, can only to a limited extent be deprived of its manurial constituents, and that the more insoluble portions will remain in the dung despite much washing by rain, we have felt it wise to insert the provision that any deduction on account of bad storage shall not exceed 50 per cent. of the value as set out in our column D (1); that is, even in the worst cases, a figure not lower than one-half the corresponding one in our table D (1) will represent the value of the manure."

In studying the effects of the different methods of storage found on the various farms, and in trying to estimate the deductions which should be made, great difficulties arose because of the contrast between the housing of fattening cattle in yards and boxes and the tying up of cows in stalls, and the consequent great difference in the management of the manure. Where bullocks are kept in covered yards and allowed a sufficient supply of litter it is possible for all the urine to be absorbed by the litter, but with cows in stalls the urine is, as a rule, disposed of quite independently of the solid excreta and litter; further, the dung is often kept in an uncovered yard exposed to leaching by rain, and the drainage from the heap has to be dealt with in some other manner. On the farms under consideration the cowsheds were, as a rule, cleaned out after the morning's milking, and during the winter a fair amount of litter was used. The dung from the cowsheds was in most instances conveyed to an open yard near the cowshed and kept there in loosely built-up heaps until it was necessary to cart it out to the land.

In order to have some guide as to the conditions obtaining on each farm, the respective farmers were asked to forward answers to the following three questions:—

1. Is the dung kept in a covered or uncovered yard?
2. Is the urine from the cowshed utilised or allowed to run to waste?
3. Is the drainage from the manure heap utilised or allowed to run to waste?

According to the answers received, the deductions for loss of manurial value through defective making and storage were estimated; where the dung was kept in an uncovered yard, and the urine from the cowshed and drainage from the dung-heap were not utilised in any way, the maximum deduction of 50 per cent. was made, and where the dung was kept under cover, and both urine and drainage were utilised, no deduction was made—*i.e.*, the gross manurial value as calculated was credited.

The returns from the various farms showed all possible

gradations between the above extremes, and deductions were made on the scale given below:—

	Conditions of Making and Storage		*Deductions from Gross Manurial Value.* Per cent.
(1)	Urine lost, dung in uncovered yard and drainage	lost ..	50
(2)	,, ,, ,, ,, ,, ,, ,, ,,	used..	45
(3)	,, ,, ,, ,, covered ,, ,, ,,	lost ..	40
(4)	,, ,, ,, ,, ,, ,, ,, ,,	used..	35
(5)	,, used ,, ,, uncovered ,, ,, ,,	lost ..	15
(6)	,, ,, ,, ,, ,, ,, ,, ,,	used..	10
(7)	,, ,, ,, ,, covered ,, ,, ,,	lost ..	5
(8)	,, ,, ,, ,, ,, ,, ,, ,,	used..	Nil.

Though the above proportions were considered very carefully before being adopted, they are certainly open to criticism and could probably be improved upon. It will be noticed that the loss of the urine from the cowshed is by far the most serious loss, the deduction for this alone being 35 per cent. of the gross manurial value, while the deduction through having the dung-heap in an uncovered yard and losing the drainage is only 15 per cent. To the practical farmer and valuer this may seem an unfair division, but the work of Dr. Crowther on the "Distribution of the Manure Values of Foods between Dung and Urine"* has shown most clearly that, as far as manurial ingredients are concerned, the urine is much more important than the dung. In the article just referred to Dr. Crowther points out that the nitrogen present in the urine is in the form of compounds easily soluble in water and rapidly fermented to ammonia, while the nitrogen in the dung is present almost entirely in the form of insoluble compounds which, when passing through the digestive tract of the animal, have resisted the action of all the agents of digestion. The nitrogen of the dung is, therefore, weight for weight, of much less value to the crop than the nitrogen of the urine, and it is finally concluded that "under the conditions of "the average farm, where the foodstuffs will be consumed by "several different classes of stock, the total liquid excreta as they "leave the animals will possess from three to four times the "manurial value of the total solid excrements, so far as these "manurial values are determined by the chemical composition of "the excreta."

In a special reference to cows, it is stated that, on the average, the urine will contain 73 per cent. of the total estimated manurial value of the excrements, and the apportioning of the deductions as stated above was made with a due appreciation of this fact. As the urine contains such a high percentage of the total

* See *Transactions of the Highl^nd and Agricultural Society of Scotland*, 1910, pp. 125–142.

manurial value of a food, it might be argued that, when the urine from the cowshed is lost, it would be more correct to discard Hall and Voelcker's suggestion that the total deduction for the worst possible management of manure should not exceed 50 per cent. of the manurial value, and to make a deduction of 60 per cent. to 70 per cent. to meet the special circumstances. Against this point of view, it must be remembered that cows spend a considerable proportion of each year in the fields, and that the urine lost from the cowshed is not, therefore, the total amount produced.

As regards the drainage from the dung-heap, it may seem incorrect to estimate this loss at only 5 per cent., whether the heap is under cover or in the open, as in the latter case a greater quantity of fertilising matter has been washed from the heap. It must be pointed out, however, that the drainage from a heap in the open is also more dilute, and because of fluctuations in amount due to rain, complete utilisation is much more difficult. The loss to the dung-heap itself when kept in the open is estimated at 10 per cent.

No account was taken of the methods of management of the dung-heap, *i.e.*, whether it was built up carefully and made as compact as possible or the opposite; but, as good management of the urine is not likely to be associated with bad management of the dung-heap, it is improbable that the omission of the particular point is a source of serious error.

When the scale of deductions for loss of urine, etc., was fixed it was applied to each individual farm; thus, on Farm A the reply received from the farmer stated that the dung was kept in an uncovered yard and that neither the urine from the cowsheds nor the drainage from the dung-heap were utilised in any way, and a deduction of 50 per cent. from the gross manurial value was therefore made, *e.g.*:—

	£	s.	d.
Gross manurial value	85	15	10
50 per cent. deduction	42	17	11
Net manurial value	£42	17	11

On Farm B the farmer stated that the dung was kept in an uncovered yard, but that the urine and drainage were collected in a tank and then used to irrigate a portion of a field. Here a deduction of 10 per cent. was made from the gross manurial value, *e.g.*:—

	£	s.	d.
Gross manurial value	67	11	9
10 per cent. deduction	6	15	2
Net manurial value	£60	16	7

TABLE II.—*Showing for each Farm the Gross Value, Deductions, and Net Value of Manurial Residues; also the Net Value per Gallon of Milk and Quantity of Concentrated Food per Cow for 12 Months, Oct., 1913, to Sept., 1914.*

LIQUID MANURE LOST.

Farm.	Gross Manurial Value.	Deductions.	Net Manurial Value.	Gallons of Milk per Annum.	Manurial Value per Gallon.	Cakes and Meals consumed per Cow.
	£ s. d.	50 % £ s. d.	DEDUCTIONS. £ s. d.		Pence.	Cwt.
AA	20 11 2	10 5 7	10 5 7	8,330	·29	26·5
P	44 10 11	22 5 5	22 5 6	23,829	·22	17·1
R	19 0 3	9 10 1	9 10 2	9,714	·23	11·9
A	85 15 10	42 17 11	42 17 11	46,221	·22	14·9
PP	39 13 2	19 16 7	19 16 7	23,087	·20	12·7
II	15 18 7	7 19 3	7 19 4	13,471	·14	12·4
JJ	28 5 6	14 2 9	14 2 9	24,278	·14	8·5
DD	18 3 5	9 1 8	9 1 9	19,883	·11	6·3*
GG	14 13 9	7 6 10	7 6 11	19,719	·08	4·8
CC	14 14 2	7 7 1	7 7 1	25,846	·06	10·2*
EE	8 10	4 5	4 5	16,917	·00	·2*
11 Farms	301 15 7	150 17 7	150 18 0	231,295	·16	—
		45 %	DEDUCTIONS.			
BB	15 18 1	7 3 1	8 15 0	12,940	·16	8·3
		40 %	DEDUCTIONS.			
C	48 12 10	19 9 1	29 3 9	28,000	·25	13·9
		35 %	DEDUCTIONS.			
E	128 13 3	45 0 7	83 12 8	36,246	·55	15·4
QQ	142 9 8	49 17 4	92 12 4	69,517	·32	13·7*
2 Farms	271 2 11	94 17 11	176 5 0	105,763	·40	—
		30 %	DEDUCTIONS.			
N	77 4 3	23 3 3	54 1 0	48,947	·26	16·9
16 Farms	714 13 8	295 10 11	419 2 9	426,945	·24	—

LIQUID MANURE USED.

Farm.	Gross Manurial Value.	Deductions.	Net Manurial Value.	Gallons of Milk per Annum.	Manurial Value per Gallon.	Cakes and Meals consumed per Cow.
	£ s. d.	15 % £ s. d.	DEDUCTIONS £ s. d.		Pence.	Cwt.
L	72 19 4	10 18 10	62 0 6	37,684	·39	16·7
O	24 18 3	3 14 8	21 3 7	14,779	·34	12·1
S	42 9 11	6 7 6	36 2 5	24,884	·34	16·0
F	38 16 8	5 16 6	33 0 2	24,045	·32	20·4
Q	30 18 3	4 12 9	26 5 6	23,192	·27	11·1
OO	30 5 5	4 10 9	25 14 8	23,040	·26	18·7
HH	6 17 9	1 0 7	5 17 2	15,915	·08	3·9*
7 Farms	247 5 7	37 1 7	210 4 0	163,539	·30	—
		10 %	DEDUCTIONS.			
I	110 17 10	11 1 9	99 16 1	32,142	·74	22·4
T	87 6 7	8 14 7	78 12 0	27,037	·69	22·6
NN	62 18 0	6 5 9	56 12 3	22,944	·59	12·4
M	87 13 1	8 15 4	78 17 9	36,033	·52	17·5*
B	67 11 9	6 15 2	60 16 7	32,023	·45	15·5
D	47 8 4	4 14 10	42 13 6	28,493	·35	12·7
K	22 17 11	2 5 9	20 12 2	14,310	·34	12·1
H	24 5 5	2 8 6	21 16 11	16,626	·31	8·1*
KK	29 18 3	2 19 10	26 18 5	26,255	·24	15·9
G	19 12 10	1 19 3	17 13 7	18,754	·22	7·7
10 Farms	560 10 0	56 0 9	504 9 3	254,617	·47	—
		5 %	DEDUCTIONS.			
J	93 11 7	4 13 6	88 18 1	30,070	·71	24·1
		No	DEDUCTIONS.			
MM	64 10 0	—	64 10 0	32,323	·47	19·6
†FF	19 16 3	—	19 16 3	24,509	·19	5·5
†LL	10 2 9	—	10 2 9	14,128	·17	6·0
21 Farms	995 16 2	97 15 10	898 0 4	519,186	·41	—
SUMMARY FOR 37 FARMS	1,710 9 10	393 6 9	1,317 3 1	946,131	·33	—

TABLE III.—*Showing for each Farm the Gross Value, Deductions, and Net Value of Manurial Residues; also the Net Value per Gallon of Milk and Quantity of Concentrated Food per Cow for 12 Months, Oct., 1914, to Sept., 1915.*

LIQUID MANURE LOST.

Farm.	Gross Manurial Value.	Deductions.	Net Manurial Value.	Gallons of Milk per Annum.	Manurial Value per Gallon.	Cakes and Meals consumed per Cow.
		50 %	DEDUCTIONS.			
	£ s. d.	£ s. d.	£ s. d.		Pence.	Cwt.
P	47 11 10	23 15 11	23 15 11	20,730	·27	17·9
A	96 12 2	48 6 1	48 6 1	47,927	·24	16·1
U	32 8 1	16 4 0	16 4 1	16,071	·24	10·8
V	46 16 10	23 8 5	23 8 5	29,139	·19	16·6
TT	22 14 6	11 7 3	11 7 3	17,411	·15	10·1
RR	13 6 3	6 13 1	6 13 2	10,756	·14	10·1
JJ	22 5 6	11 2 9	11 2 9	21,497	·12	7·1
GG	16 6 0	8 3 0	8 3 0	18,616	·10	5·8
8 Farms	298 1 2	149 0 6	149 0 8	182,147	·19	—
		45 %	DEDUCTIONS.			
BB	19 5 5	8 13 5	10 12 0	11,940	·21	12·3
		40 %	DEDUCTIONS.			
C	47 4 0	18 17 7	28 6 5	30,780	·22	13·6
		35 %	DEDUCTIONS.			
QQ	123 11 7	43 5 0	80 6 7	60,227	·32	14·8*
		30 %	DEDUCTIONS.			
N	83 13 5	25 2 0	58 11 5	48,909	·28	16·2
12 Farms	571 15 7	244 18 6	326 17 1	334,003	·23	—

LIQUID MANURE USED.

Farm.	Gross Manurial Value.	Deductions.	Net Manurial Value.	Gallons of Milk per Annum.	Manurial Value per Gallon.	Cakes and Meals consumed per Cow.
		15 %	DEDUCTIONS.			
	£ s. d.	£ s. d.	£ s. d.		Pence.	Cwt.
Q	68 15 4	10 6 3	58 9 1	28,471	·49	18·1
F	36 13 6	5 10 0	31 3 6	21,574	·34	18·5
O.O	38 2 9	5 14 5	32 8 4	24,282	·32	21·5*
L	58 2 10	8 14 5	49 8 5	37,792	·31	13·1
S	41 16 10	6 5 6	35 11 4	29,929	·28	13·3
O	17 6 2	2 11 11	14 14 3	15,628	·22	10·7
HH	—	—	—	14,691	—	—*
7 Farms	260 17 5	39 2 6	221 14 11	172,367	·30	—
		10 %	DEDUCTIONS.			
T	136 9 10	13 12 11	122 16 11	35,382	·83	35·7
NN	101 13 10	10 3 4	91 10 6	27,523	·79	19·7
I	77 8 6	7 14 10	69 13 8	29,283	·57	18·4
W	87 4 2	8 14 5	78 9 9	33,353	·56	19·1
B	77 17 4	7 15 8	70 1 8	32,240	·52	16·3
SS	37 15 4	3 15 6	33 19 10	16,394	·49	16·5
M	82 16 5	8 5 7	74 10 10	37,735	·47	16·0*
V	82 18 2	8 5 10	74 12 4	38,643	·46	17·2
D	45 8 8	4 10 10	40 17 10	26,143	·37	9·1
K	22 13 3	2 5 3	20 8 0	14,366	·34	9·7
KK	37 14 0	3 15 4	33 18 8	26,225	·31	15·3
H	23 10 9	2 7 0	21 3 9	17,437	·29	9·2*
G	23 7 7	2 6 9	21 0 10	20,658	·24	8·5
13 Farms	836 17 10	83 13 3	753 4 7	355,376	·51	—
		5 %	DEDUCTIONS.			
J	97 3 4	4 17 2	92 6 2	32,389	·68	21·1
		NO	DEDUCTIONS.			
MM	36 4 2	—	36 4 2	30,946	·28	10·3
†LL	8 4 7	—	8 4 7	12,369	·16	4·7
†FF	15 13 5	—	15 13 5	24,081	·15	5·4
24 Farms	1,255 0 9	127 12 11	1,127 7 10	627,528	·43	—

On the two farms where the cows were lying out at night, summer and winter, no deduction was made, however badly the manure was stored or utilised.

Relation of Manurial Value to Cost of Food in the Production of Milk.—The statement of such results as the above for each farm supplies interesting information for some most instructive comparisons, but in order to arrive at the relation between the manurial values of foods and the cost of food in milk production it was necessary to continue a stage further. For each of the farms the total quantity of milk produced during each period of twelve months was calculated from the weekly milk record sheets, and with this additional information it was not difficult to determine the manurial value of the foods used in the production of 1 gal. of milk. For example, on Farm A, with a net manurial value of £42 17*s.* 11*d.* and a milk production of 46,221 gal., the manurial value per gal. was found to be ·22*d.* On Farm B, with a net manurial value of £60 16*s.* 7*d.* and a milk production of 32,023 gal., the manurial value per gal. was 45*d.* Thus, if, without allowing for the manurial residues, the cost of food per gal. of milk had been 6*d.* on each of these farms, this cost would have been reduced to 5·78*d.* per gal. and 5·55*d.* per gal. on A and B respectively.

In the tables on pp. 218 and 219, the farms are arranged in groups according to the deductions which had to be made from the gross manurial value for inefficient methods of storage and management. Table II. deals with the 12 months October, 1913, to September, 1914, and Table III. with the 12 months October, 1914, to September, 1915. The results are given for each farm, and a column has been added showing the consumption of cakes and meals per cow per annum.

Farms with 50 per cent. Deduction.—On 11 farms in 1913-14, and on 8 in 1914-15, the manure was kept uncovered, and the drainage from the heap and that from the cowshed were both allowed to run to waste (four farms were included in both years). In the first year, the gross manurial value on the group of farms was nearly £302, and the net amount to be credited to the cows nearly £151, equal to ·16*d.* per gal. of milk produced on the farms. In the second year the gross manurial value on the group of farms was £298, and the net amount to be credited to the cows £149, equal to ·19*d.* per gal. of milk.

Farms with 15 per cent. Deduction.—On 7 farms in 1913-14, and on the same 7 farms in 1914-15, the urine from the cowsheds was utilised, but the dung-heap was uncovered and the drainage

lost. In the first year the gross manurial value was fully £247, and the proportion to be credited fully £210, equal to ·30*d.* per gal. of milk produced. In the second year the gross manurial value was almost £261, and the proportion to be credited almost £222, being again equal to ·30*d.* per gal. of milk.

Farms with 10 per cent. Deduction.—On 10 farms in 1913-14, and on the same 10 and 3 additional farms in 1914-15, facilities existed for collecting and using all the liquid manure, but the dung-heap was uncovered. In the first year the gross manurial value for the group of farms was fully £560, while the proportion credited to the cows was fully 504, equal to ·47*d.* per gal. of milk produced. In the second year the gross manurial value was nearly £837, and the amount to be credited rather over £753, equal to ·51*d.* per gal. of milk.

Only one farm had a sufficiently good system for storing and using both urine and dung to have the gross manurial value credited, but on two other farms, where the cows were always out of doors day and night, no deductions were made.

Summary for All Farms.—Grouping all the farms together, in 1913-14 the gross manurial value amounted to £1,710 9*s.* 10*d.*, of which sum £1,317 3*s.* 1*d.* represents the net manurial value to be credited to the cows, equal to ·33*d.* per gal. of milk produced. In 1914-15 the gross manurial value totalled £1,826 16*s.* 4*d.*, of which sum £1,454 4*s.* 11*d.* was credited to the cows, equal to ·36*d.* per gal. of milk. In other words, had the average cost of food per gal. of milk on these farms been 6*d.*, the allowance to be made for the manurial value of the concentrated foods in each year would have reduced that figure to 5·67*d.* and 5·64*d.*, respectively.

The figures for the individual farms for the two years show a range of manurial values per gal. of milk of from ·00*d.* to ·83*d.*, and with such a wide range it would not be wise to apply the average of ·33*d.* or ·36*d.* per gal. generally. Where, however, there is some information regarding the management of the manure, it is possible to give a more useful average; thus, on the farms where the urine from the cowshed was lost, the range is from ·00*d.* to ·55*d.* per gal., or, excluding the two extreme figures, from ·06*d.* to ·32*d.* per gal., with an average of ·23*d.* Further, on those farms where the urine was utilised, excluding one farm where no concentrated food was fed, the range was from ·08*d.* to ·83*d.* per gal., or excluding the lowest, from ·15*d.* to ·83*d.* per gal., with an average of ·42*d.* These figures may be useful where it is desired to make corrections for manurial

value in the cost of food per gal. of milk, but where it is not possible to make calculations for each farm.

Reasons for Variation in Manurial Values per Gallon.—A comparison of the results from the groups of farms in the foregoing tables shows that the methods of management of the liquid and solid manure is one cause of variation in the results from the individual farms, but at least two other factors must be taken into account. These are (*a*) the quantity of cakes and meals used, and (*b*) the variation in manurial value of individual cakes and meals.

As regards (*a*), the column giving the quantity of cakes and meals consumed per cow per annum clearly distinguishes the farms on which large quantities of concentrated foods were used, and it will be noticed that the allowance per cow is very variable. On some farms the comparatively small quantity per cow is due to the use of wet grains, and those farms are indicated in the tables by an asterisk. On others the possession of good sheltered pastures for autumn and winter grazing, or a large supply of home-grown fodder, tends to lower the quantity of concentrated food per cow, while the presence of a large proportion of cows in full milk during the winter tends in the opposite direction; also, the personal opinions of the farmers as to what constitutes a good ration for milk production exercise an incalculable effect.

It is, however, very evident that on some farms where the management of the manure and the quantities of cakes and meals allowed per cow are about the same, the manurial value shows a remarkable difference. The cause of this is as stated above under (*b*), the variation in manurial value of individual cakes and meals. A good example of this variation is seen in the particulars of two farms, G and KK, in the 10 per cent. deduction group in Table II.

FARM G.

Food.	*Quantity Used.* t. c. lb.	*Manurial Value per ton.* s. d.	*Gross Manurial Value.* £ s. d.
Decorticated Cotton Seed Meal	19 28 ..	64 9 ..	3 2 4
Soya Bean Cake	19 105 ..	60 10 ..	3 0 10
Linseed Cake	1 2 10 ..	44 4 ..	2 8 11
Egyptian Cotton Cake ..	1 11 37 ..	37 1 ..	2 18 1
Bombay „ „ ..	14 70 ..	33 8 ..	1 4 7
Compound Dairy Meal ..	4 11 7 ..	30 4 ..	6 18 1
		Total ..	£19 12 10
10 per cent. Deduction ..	..	.. ..	1 19 3
Net Manurial Value ..	..	.. ..	£17 13 7

Milk Yield, 18,754 gal., *i.e.*, Manurial Value per gal. = ·22*d.* per gal.
Cakes and Meals, per cow .. .. = 7·7 cwt.

FARM KK.

Food.		*Quantity Used.*		*Manurial Value per ton.*		*Gross Manurial Value.*
		t. c. lb.		s. d.		£ s. d.
Egyptian Cotton Cake	..	3 1 0	..	37 1	..	5 13 1
Dried Grains	..	1 10 0	..	29 0	..	2 3 6
Maize Germ Meal..	..	6 15 28	..	20 7	..	6 19 2
Oats	..	14 5 0	..	17 11	..	12 15 3
Barley Meal	..	3 0 42	..	15 8	..	2 7 3
						£29 18 3
10 per cent. Deduction					..	2 19 10
Net Manurial Value..					..	£26 18 5

Milk Yield, 26,255 gal., *i.e.*, Manurial Value per gal. = .24*d*. per gal.
Cakes and Meals, per cow .. .. = 15.9 cwt.

On Farm G cakes and meals only, with a manurial value per ton ranging from 30*s*. 4*d*. to 64*s*. 9*d*., were consumed, while on Farm KK by far the most popular foods were cereals and meals, with a manurial value ranging from 15*s*. 8*d*. to 29*s*. per ton; a quantity of Egyptian cotton cake was also used. The above comparison shows that 7¾ cwt. per cow of rich foods on Farm G have a manurial value per gal. of milk almost equal to 16 cwt. of cereals and cereal by-products on Farm KK. Similar examples to the above could be quoted from other farms, notably L and OO in the 15 per cent. group in Table II.

One other point must be mentioned: it has been stated that the information regarding the conditions of management of the liquid and solid excreta on each farm was supplied by each individual farmer, and the results have been worked out on this basis. No attempt was made to determine what use was made of the facilities existing at each farm, and it is quite possible that on a number of farms the loss of manurial ingredients has been under-estimated. Although the drainage from the cowshed and dung-heap is collected in a tank or used for irrigation purposes, it does not necessarily follow that the tank is in good repair or emptied when necessary, or that the irrigation channels are carefully looked after. These matters might receive the attention of a valuer in a case of a claim for residual manurial value, but for several reasons they were omitted from the scope of the present inquiry.

In conclusion, attention may be drawn to the value of the manurial residues lost through the non-utilisation of the liquid manure or the exposure of the dung. The gross manurial value of the concentrated foods used in 1913-14 on the 37 farms was calculated to be fully £1,710, while the net value was £1,317; the difference of £393 is the value of the lost manurial ingredients, but of this sum £296 was lost on 16 farms where the

liquid manure was not utilised, *i.e.*, a loss of soluble and quick-acting ammonia and potash compounds to the value of £18 10*s*. per farm. In 1914-15 the total loss in manurial value on 36 farms was found to be fully £372, and of this sum almost £245 was lost on 12 farms where the liquid manure was not utilised, equal to a loss of £20 8*s*. per farm. The lack of efficient drainage in the cowsheds and the absence of manure tanks and covered yards is no doubt primarily responsible for this serious loss of valuable fertilising materials, but greater care on the part of the farmer himself could, in the majority of cases, bring about a most profitable improvement.

SILAGE MADE FROM OATS AND TARES AS A FOOD FOR MILKING-COWS.

A. W. OLDERSHAW, B.SC. (EDIN.), N.D.A.,

Agricultural Organiser for East Suffolk.

IN view of the increasing interest at present being taken in the manufacture of silage* it was considered desirable to conduct an experiment to test the feeding value of that material as compared with roots and chaff.

By kind permission the experiment was conducted on the farm of Mr. C. C. Smith, J.P., of Walton Hall, Felixstowe. The silage was made in a cylindrical silo of wooden staves, bound round with iron bands.

A mixture of oats and tares, at the rate of 1 bush. of oats and 2 bush. of tares per acre, was sown in the autumn of 1914. Twenty loads of farmyard manure per acre were ploughed in as a manure for the oats and tares. The previous crop was wheat. The silage crop was chaffed and put into the silo late in June, 1915. The weight of green oats and tares per acre was estimated, by weighing portions in different parts of the field, to be 14 tons 1 cwt. It may also be mentioned that after removing the oats and tares the land was ploughed up and sown with white turnips. These weighed (tops and roots together) 15 tons per acre in the early spring of 1916.

Twelve cows were selected and divided into two lots in such a way that at the commencement of the experiment there was one recently-calved cow and one heifer in each lot, the remainder of the cows being average milkers. The milk of the cows was weighed at every milking during the experiment.

* At least 40 silos of the modern cylindrical type have been erected in East Anglia since April, 1914.

Scope of the Experiment.—The experiment was designed to test the feeding value for milk production of 60 lb. of silage as compared with that of 60 lb. of mangolds and 7 lb. of chaffed straw.

It was originally intended to test silage against roots alone, but it was subsequently decided that it would be better to add chaff to the roots, as is done almost invariably in ordinary farming practice.

Foods actually Fed.—Previous to the commencement of the experiment all the cows had been receiving the same food, consisting of roots, silage, ground-nut cake, dried grains, chaffed straw and long hay.

Throughout the experiment, except during the last week, the rations only differed in that one lot received silage and the other lot mangolds and chaff.

The cows received the following foods from Friday afternoon, 21st January, 1916: —

Lot I.	*Lot II.*
Experimental Ration.	*Experimental Ration.*
60 lb. silage.	60 lb. mangolds (Yellow Globe).
	7 „ chaffed oat-straw.
Basal Ration.	*Basal Ration.*
4 lb. dried grains.	(As Lot I.)
2 „ ground-nut cake.	
7 „ long hay (rather damaged) (chaff after 11th February).	

The experiment was regarded as having commenced on Monday afternoon, 24th January, the period between Friday and Monday being allowed to give the cows time to get accustomed to the change in food.

On Friday afternoon, 11th February, it was decided to discontinue feeding the hay, as the cows wasted a good deal of it and it was impossible to weigh the quantity actually eaten, and to substitute 7 lb. of chaffed oat-straw with both lots. It was also considered desirable that the cows should be rather under than over-fed, in order to bring out any difference in the feeding value of the rations.

After that date, therefore, Lot I. received 7 lb. and Lot II. 14 lb. of chaffed oat-straw.

After the expiration of four weeks, *i.e.*, on Monday afternoon, 21st February, the foods were changed over, Lot I. receiving roots and chaff and Lot II. silage, the amount of cake and dried grains fed to each lot continuing the same. The change from silage to roots and vice versa was made suddenly, but no bad effects followed with either lot of cows. It was observed, how-

ever, that Lot II., previously fed upon roots and chaff did not eat up their food, when placed upon silage, for three days, after which they ate it up well. The cows of Lot I., now placed upon roots and chaff, ate their ration well the whole time.

Owing to the fact that all the oat-straw chaff was used up by 1st March, second crop clover-stalk chaff (*i.e.*, the straw left after threshing red clover seed) was then substituted for the oat-straw chaff. On 21st March this material also ran out, and from that time till the end of the experiment, barley awns were used instead of oat-straw chaff.

During the period of the experiment all the cows kept up their flesh with the exception of K62 in Lot I. and K47 in Lot II., both of these cows being heavy milkers. No facilities existed for weighing the cows or this would have been done. In view of their loss of flesh, however, it was decided on Friday morning, 3rd March, to give both the above-mentioned cows additional food, *i.e.*, 20 lb. extra roots and chaff in the case of K62 and a similar quantity of silage in the case of K47.

On Monday, 20th March, the commencement of the 9th week of the experiment, probably owing to two days of warm weather, the cows of Lot II. receiving silage would not eat up their food. The rations were, therefore, reduced by 10 lb. of silage, Lot I. continuing to receive the same quantity of roots.

Diary of Modifications of Rations in both Lots of Cows.

1916.		
24th January	..	Experiment commenced.
11th February	..	7 lb. of oat-straw chaff substituted for 7 lb. of hay, *i.e.*, root-fed cows now getting 14 lb. chaff.
21st February	..	Foods reversed.
1st March	..	Clover-stalk chaff substituted for oat-straw chaff.
3rd ,,	..	One cow in each lot received 20 lb. additional silage, or roots and chaff.
20th ,,	..	Rations of Lot II reduced by 10 lb. of silage.
21st ,,	..	Barley awns substituted for clover-stalk chaff.
27th ,,	...	Experiment concluded.

Composition of the Rations Fed.—A sample of the silage, analysed at the East Anglian Institute of Agriculture (through the courtesy of the Principal, Mr. R. M. Wilson, B.Sc.) by Mr. G. S. Robertson, M.Sc., showed the following composition (per cent.):—Moisture, 72·30; oil, 1·14; albuminoids, 4·96; soluble carbohydrates, 9·75; fibre, 9·43; ash, 2·42.

Taking the composition of foods given in the Board's Leaflet

No. 79 (*Rations for Farm Stock*) the following table shows the composition of the rations fed during the major portion of the experimental period:—

	Total Ingredients present in lb.					Digestible.	
	Dry Matter.	Albuminoids.	Oil.	Carbohydrates.	Fibre.	Albuminoids.	Starch equivalent.
Silage Ration.							
60 lb. silage	16·62	2·97	·68	5·85	5·65	·83	6·24
4 „ dried grains ..	3·64	·80	·24	1·72	·64	·56	2·00
2 „ ground nut cake*	1·81	·94	·14	·49	·11	·82	1·51
7 „ oat-straw chaff	6·02	·24	·14	2·66	2·59	·07	1·33
	28·09	4·95	1·20	10·72	8·99	2·28	11·08
Roots and Chaff Ration.							
60 lb. mangolds ..	7·20	·75	·15	5·40	·60	·30	4·20
4 „ dried grains ..	3·64	·80	·24	1·72	·64	·56	2·00
2 „ ground nut cake*	1·81	·94	·14	·49	·11	·82	1·51
14 „ oat-straw chaff	12·04	·49	·28	5·32	5·18	·14	2·66
	24·69	2·98	·81	12·93	6·53	1·82	10·37

Table giving Weekly Milk Yield of Cows, 1916.

Ear Mark of Cows.	Date of Calving.	(1) Week ending 31st Jan.	(2) Week ending 7th Feb.	(3) Week ending 14th Feb.	(4) Week ending 21st Feb.	(5) Week ending 28th Feb.	(6) Week ending 6th Mar.	(7) Week ending 13th Mar.	(8) Week ending 20th Mar.	(9) Week ending 27th Mar.	(10) Total Yield During Experimental Period.
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Lot (1)			SILAGE.				MANGOLDS AND CHAFF.				
K 758	11th Nov.	195¼	175¼	167½	168	155	149¼	141	139½	135½	1,426¼
K 765	14th „	218¾	212	201	188¼	102	181¼	174¼	168¼	158	1,604¼
K 859	26th July	129¾	122¼	119½	114¾	101¼	93¾	86¾	74¼	63¾	906
K 753	16th Nov.	178¼	169	162¼	152¾	155½	159	161¾	150	148½	1,436¾
K 66	21st Oct.	212	209½	202¼	194	189½	187	183½	176¼	173½	1,727¾
K 62	6th Jan.	208	295½	278¾	259¼	234	194	219¼	212¾	208¼	2,110
		1,142	1,183½	1,131¼	1,077	937	964¼	966¾	921¼	887¾	9,211
Lot (2)			MANGOLDS AND CHAFF.					SILAGE			
K 905	30th Sept.	146	132½	139½	141¼	130	115	105¼	96	95¼	1,101
K 63	14th Oct.	136¼	125½	125	116¼	108	101	94¾	90½	87¼	984¾
K 47	4th Jan.	285½	269	285½	293½	281½	269	253¼	236¼	238½	2,412¼
K 57	2nd Aug.	185¼	173¾	105¾	166	153¼	144¾	137¼	124¾	121¾	1,372¾
K 41	15th June	159	148¾	143	143¾	138¼	124½	115¼	104¼	105½	1,182¼
K 51	2nd Aug.	137¾	134¼	135¼	133¼	124¾	122	112¾	97¼	88¾	1,086
		1,049¾	983¾	994	994	936	876¼	819	749	737¼	8,139

Weekly Yields.—The weekly milk yield of the cows of Lots I. and II. are given in the table above. An examination of the figures shows that the cows of Lot. I. were really superior to those of Lot II. in point of milk yield. It is probable, however, that this difference was eliminated by changing over the food during the experiment.

* Composition taken from booklet compiled by Mr. G. S. Robertson, and issued by the East Anglian Institute of Agriculture.

The first 8 weeks of the experiment yield the following results:—

	Yield of milk in lb.
Silage (with basal ration of concentrated food, etc.)—	
6 cows of Lot I. fed on silage for 1st 4 weeks ..	4,533¾
6 cows of Lot II. fed on silage for 5th, 6th, 7th and 8th weeks	3,380¼
TOTAL	7,914
Mangolds and Chaff (with basal rations of concentrated food, etc.)—	
6 cows of Lot II. fed on mangolds and chaff for 1st 4 weeks	4,021½
6 cows of Lot I. fed on mangolds and chaff for 5th, 6th, 7th and 8th weeks	3,789½
TOTAL	7,811

The difference in the two yields is only 103 lb., *i.e.*, about 10 gal.—a difference which may be regarded as almost negligible.

As previously noted, during the ninth week of the experiment the cows receiving silage would not eat all their food—probably owing to a sudden spell of warm weather—and it was therefore necessary, in order to avoid waste, to reduce the quantity of silage fed to them.

In consequence of this it is not possible to include that week in the general results. As the cows of Lot I. were undoubtedly superior to those of Lot II. it is impossible to form any definite conclusion from the milk yield of the last week.

Quality of the Milk.—It may be mentioned that no offensive odour or other abnormality was noted in any of the milk produced during the whole period of the experiment.

Owing to pressure of work due to the War, it was found impossible to test the milk of individual cows for quality at frequent intervals, as would undoubtedly have been desirable.

It is worthy of note, however, that the herds of three members of the East Anglian Milk Recording Society (Ipswich Branch) have been fed largely upon silage during the past winter, and that composite samples of the morning and evening milks have been taken and tested for butter-fat on a number of occasions. The average of 9 samples of morning's milk taken since 4th December from these herds—the cows being of mixed breeds, with a large proportion of Holstein—gave 3·1 per cent. of butter-fat, whilst an average of 9 samples of afternoon's milk from the same herds

gave 3·6 per cent. of butter-fat. Two samples of morning's milk gave 2·9 per cent. of butter-fat, all the other samples being up to the 3 per cent. standard. There would appear, therefore, to be no evidence that silage adversely affects the percentage of butter-fat in milk.

Labour involved in Feeding Silage as compared with that of Feeding Roots.—It was found that owing to the fact that the silage was ready chaffed, whereas the roots had to be cleaned and pulped, the preparation and mixing of silage with concentrated foods ready for feeding involved distinctly less labour than was the case with the roots.

Summary of the Results of the Experiment.—Six cows fed upon a daily ration of 60 lb. of silage made from oats and tares, together with concentrated foods and chaff (this ration being slightly modified from time to time, as explained on p. 226), gave approximately the same quantity of milk as 6 cows fed upon a daily ration of 60 lb. of mangolds and 7 lb. of chaff, together with a similar quantity of concentrated food and chaff to that fed to the silage cows (this ration being also slightly modified from time to time).

As the rations were identical in every other respect, it may be taken that 60 lb. of silage gave approximately the same results as 60 lb. of mangolds and 7 lb. of chaff.

It may be mentioned that this experiment does not enter into the question of the value of silage for store cattle or for beef production. On these subjects direct experiments in this country are wanting. The writer is acquainted with two cases—a bull on the farm of Mr. C. C. Smith, and a large number of young store cattle on the Ringsfield farms of Mr. F. W. D. Robinson, J.P., of Roos Hall, Beccles, which have been fed on silage alone, throughout practically the whole winter of 1915-1916. All these cattle have thriven well, and it would appear that when fed alone to such animals oat and tare silage is quite a suitable food.

It is recognised that the results of a single experiment cannot be regarded as affording a solution to the problem of the feeding value of silage, but in view of the interest at present taken in the subject it was felt to be desirable to publish them.

The writer desires to express his indebtedness to Mr. C. C. Smith for so kindly allowing the experiment to be conducted on his farm, and to Messrs. R. M. Wilson and G. S. Robertson, of the East Anglian Institute of Agriculture, Chelmsford, for supplying him with the analysis of the silage.

FECUNDITY OF HENS IN RELATION TO SIZE OF EGG.

EDWARD BROWN.

MANY complaints have been made within recent years of an *increasing tendency* to a reduction in the size of the home-produced eggs placed upon our markets. That there is such a tendency is evident. The demand is for eggs which weigh from 2 to $2\frac{1}{4}$ oz. Very large eggs are not desired for boiling, and the trade for the former class of egg is highest in value. An egg weighing $2\frac{1}{2}$ oz. to $2\frac{3}{4}$ oz. realises no more money than one of the standard weight mentioned. On the other hand, except in the two or three weeks of greatest scarcity, eggs which fail to reach 2 oz. are depreciated in market value to a much greater extent than the actual reduction in volume. Such as are below $1\frac{3}{4}$ oz. fall into the cooker class, no matter how good they may be otherwise. Whether loss of nutritive value corresponds to that of weight need not be discussed. There is and must be a standard of size. The business of producers is to conform to it as far as possible.

An idea is prevalent that increased fecundity tends to reduction in the size of egg produced. It is of great importance to poultry-keepers to know how far the evidence obtainable justifies that assumption. The following statement is based upon the figures published in the Report of the Northern Utility Poultry Society's Laying Competition, 1914-15. Owing to the fact that the number of competing pens of breeds other than White Wyandotte and White Leghorn was small, they are disregarded.

Only the White Wyandottes and White Leghorns are dealt with. Of the former, in the open classes, 162 pullets competed, and of the latter 156. As these were sent from different flocks they may be regarded as fairly representative, although selected specimens. In each case the birds in large and small houses are combined.

Fortunately the numbers of eggs laid by each pullet are divided into first grade (2 oz. and upwards), second grade ($1\frac{3}{4}$ oz. to 2 oz.), and third grade (under $1\frac{3}{4}$ oz.). As only the eggs in the first grade meet market requirements they alone are here dealt with. Had it been possible to show the proportions for the (1) winter, (2) spring, and (3) summer laying cycles of the period of nearly 12 months, evidence would have been forthcoming as to how far advances in size take place, and whether the heavier winter laying birds lay smaller eggs continuously than

those coming into profit later. In the tables the total number of eggs produced is taken, not the seasonal laying.

TABLE I.—*White Wyandottes.*

Position as to Number of Eggs Laid.	*Breed Position in Competition.*	*Total Pen Number of Eggs Laid.*	*Percentage of First Grade Eggs.*	*Position of Pen in First Grade Eggs.*
1	2	1,336	8·16	25
2	1	1,254	78·15	2
3	4	1,254	2·79	27
4	3	1,159	51·60	16
5	5	943	59·26	10
6	7	922	65·84	9
7	13	912	6·59	26
8	9	886	46·84	18
9	15	883	41·22	19
10	6	880	66·59	7
11	8	865	76·99	3
12	10	852	90·14	1
13	16	850	72·82	4
14	14	849	70·08	5
15	18	840	66·31	8
16	12	832	58·77	12
17	11	827	55·98	14
18	17	811	68·92	6
19	19	798	32·08	21
20	20	789	33·46	20
21	22	749	10·94	24
22	23	745	52·88	15
23	25	743	49·79	17
24	21	741	57·89	13
25	26	734	25·34	22
26	24	732	59·19	11
27	27	594	18·01	23

In the case of White Wyandottes Table I. shows the total number of eggs per pen, the percentages of first grade eggs for each lot, and the position occupied by these, so far as average size of first grade eggs is concerned.

The pen from which the highest number of eggs was obtained stands lowest but two in percentage of first grade eggs, the poorest of all in that respect standing third on the list as to number of eggs laid, while that which was lowest as regards the number of eggs was nearly the lowest also in point of first grade eggs. On the other hand the pen second in total number of eggs was also second in respect to size of egg. At the same time, with exceptions, the figures in respect to size of egg favour the pullets which were medium in fecundity. Be it noted that racially White Wyandottes are layers of small-sized eggs. The average of first grade eggs laid by the 162 birds was 49·13 per cent. There is, however, no measure of uniformity throughout, as the variations are very great. Taking groups in respect to total fecundity the first grade eggs are as follows:—

Production of Eggs per Pen.	*Number of Birds.*	*Average Percentage of First Grade Eggs.*
1,000 and over	24	35·17
900–1,000	18	43·89
800–900	66	64·97
700–800	48	40·20
500–600	6	18·01

Thus the mean of the breed in both directions to secure good marketable size, though the average is a low one, is from 800 to 900 eggs per six birds per annum.

Table II. deals with White Leghorns in the same manner:—

TABLE II.—*White Leghorns.*

Position as to Number of Eggs Laid.	*Breed Position in Competition.*	*Total Pen Number of Eggs Laid.*	*Percentage of First Grade Eggs.*	*Position of Pen in First Grade Eggs.*
1	1	1,208	92·63	6
2	2	1,153	72·85	18
3	5	1,066	77·39	15
4	4	1,065	83·00	11
5	8	1,061	60·97	23
6	3	1,042	96·25	1
7	9	1,036	95·46	3
8	12	1,027	66·30	21
9	11	1,017	93·90	4
10	10	1,016	69·68	20
11	7	1,001	82·01	12
12	15	1,001	91·10	7
13	6	995	55·88	24
14	14	981	93·56	5
15	13	954	88·88	10
16	17	953	78·59	14
17	22	947	37·38	26
18	21	920	89·13	9
19	20	914	89·38	8
20	16	905	80·88	13
21	18	903	76·52	16
22	19	903	52·82	25
23	23	862	63·10	22
24	24	830	74·94	17
25	25	701	95·56	2
26	26	631	71·79	19

Many comparisons can be made between White Wyandottes and White Leghorns in this competition other than those relating to the size of egg; notably, that whilst three of the former were above any of the latter, and that the first pen of Wyandottes was 128 eggs (over 10 per cent.) ahead of the first lot of Leghorns, the average of the Leghorns was much the higher. Against 12 lots of Leghorns laying more than 1,000 eggs there were only 4 lots of Wyandottes, and against 10 lots of Leghorns laying from 900 to 1,000 eggs there were only 3 lots of Wyandottes. Moreover, the range of variation was less marked in Leghorns, both in regard to number and size of eggs. Of the White Wyandottes only 3 pens averaged more than 75 per cent. of first grade eggs, whereas of White Leghorns there were 16 lots that did so. As shown in Table II., there is nothing to indicate that high fecundity is responsible for any diminution of the size of egg. The pen of Leghorns that was third in that breed was top in first grade eggs (96·25 per cent.), and the pen which was second in respect to first grade eggs (95·56 per cent.) was last save one in the total number of eggs laid.

The average of the entire lot of White Leghorns (156 birds) in first grade eggs was 78·07 per cent., or 29 per cent. above the Wyandottes. Taking, in this case also, groups in respect to total fecundity, the first grade eggs were as under:—

Production of Eggs per Pen.	*Number of Birds.*	*Average Percentage of First Grade Eggs.*
1,000 and over ..	72 ..	81·79
900–1,000 ..	60 ..	74·30
800–900 ..	12 ..	69·02
600–800 ..	12 ..	83·67

From the figures it seems to be evident that production by Leghorns ranging between 160 and 200 eggs per annum, has, as yet, had no appreciable effect upon the size of egg. The reason for decline in weight of eggs must, if these figures are any guide, be looked for in other directions.

Leghorns are naturally more prolific than Wyandottes, and it may be expected, therefore, that forcing production will have a greater physical influence upon the latter, especially as the eggs are smaller than those of the former. To that extent general conclusions may be modified. In the open section at Burnley 21 White Wyandottes laid 200 eggs and upwards, and in these the first grade eggs only averaged 38·18 per cent., that is, 10·95 per cent. below the average of all the Wyandottes. Of the Leghorns 26 laid 200 eggs and over, the first grade eggs averaging 79·71 per cent., namely, 1·64 per cent. *above* the average of all Leghorns.

COMPOSITION OF BASIC SLAGS, SOLD AS MANURE IN THE WINTER OF 1915–16.

WITH a view to ascertaining the composition of the slags on sale during the past winter, samples were obtained during December, 1915, and January, 1916, from steel and slag works, from traders dealing in fertilisers, and from farmers, and were analysed at the Government laboratory.

Before making the analysis, the weight of the entire sample as received was taken, and the portions of metal and fragments of slag that would not pass through a sieve with a mesh of 1 millimetre diameter were removed and weighed. The determinations were made in duplicate upon the material which passed through the millimetre sieve, the results being afterwards calculated as percentages on the original sample.

The results are stated in the table on p. 234

No.	Percentage of				Guarantees.		
	Sub-stance not passing 1 mm. sieve.	Total phos-phates as tri-calcium phos-phate.	Citric-soluble phos-phates as tri-calcium phos-phate.	Fine-ness.	Total phos-phates.	Citric-soluble phos-phates.	Fine-ness.
		Samples from Steel and Slag Works.					
1	0·06	25·6	25·5	88	—	—	—
2 (*a*)	1·56	21·1	18·4	72	18	9	—
2 (*b*)	2·04	20·1	17·7	73	18	9	—
14	0·42	20·9	19·3	86	—	22	—
15	0·33	41·0	36·1	88	42	—	—
16	1·43	32·8	30·1	97	30	—	—
20	0·82	18·8	12·6	78	18	9	80
		Samples from Traders in Fertilisers.					
3	1·11	24·4	23·7	77	22	—	—
4	0·88	24·8	24·1	78	24	—	—
5	0·43	28·6	27·5	87	—	26	—
6	0·92	25·0	23·9	76	—	22	80
7	0·30	25·5	24·5	80	—	24	80
8	0·90	38·2	36·6	79	—	32	80
9	0·17	24·4	23·7	82	—	24	85
10	0·79	39·1	34·9	96	30	27	85
11	0·39	22·8	21·2	84	—	22	80
12	0·49	37·7	35·9	85	—	34	80
13	1·05	30·7	28·8	97	42	—	—
21	1·91	27·7	25·3	79	—	26	—
22	0·18	29·6	29·0	87	—	24	85
		Samples from Farmers.					
17	0·28	27·1	24·2	89	—	24	80
18	1·64	24·4	23·3	89	24	{ 19·2 21·6	— —
19	3·04	18·7	13·6	72	—	—	—
23	1·53	27·5	25·8	97	30	24	85
24	0·60	40·7	36·0	91	42	33·4	—
25	0·52	25·7	23·5	82	—	—	—

Nineteen samples contain from 18 to 30 per cent. of *total* phosphates, and seven from 30 to 42 per cent., while 20 samples contain from 12 to 30 per cent. of *soluble* phosphates, and 6 from 30 to 38 per cent.

The percentage solubility of the phosphates is 67·0 and 72·7 respectively, in the case of two samples; between 87 and 90 in the case of six samples; and over 90 in the case of the remaining samples.

The range of total phosphates in the slags is from 18·7 to 41·0 per cent., and of soluble phosphates from 12·6 to 36·6 per cent. The following table shows the total and soluble phos-

phates respectively, for each 2 per cent. between the extremes of these ranges:—

Percentage of Phosphates in Sample.	*Number of Samples.* *Total.*	*Soluble.*
12 and under 14	–	2
14 " " 16	–	–
16 " " 18	–	1
18 " " 20	2	2
20 " " 22	3	1
22 " " 24	1	5
24 " " 26	8	6
26 " " 28	3	1
28 " " 30	2	2
30 " " 32	1	1
32 " " 34	1	–
34 " " 36	–	2
36 " " 38	1	3
38 " " 40	2	–
40 " " 42	2	–
TOTAL	26	26

A guarantee as to the quantity of phosphates is given in the case of 23 of the samples, and the results show that of these samples, 15 fully satisfy the guarantee without making any allowance under the Limits of Error Regulations, five are within the guarantee if the statutory allowance is made, and only three do not fulfil the guarantee. Of the last three, No. 14 contains 19·3 per cent. of soluble phosphates, whereas the guarantee is 22 per cent., *i.e.*, 20 per cent. after deducting the allowance; and No. 23 contains 27·5 per cent. of total phosphates, whereas the guarantee is 30 per cent., *i.e.*, 28 per cent. after deducting the allowance; the other sample, No. 13, contains only 30·7 per cent. of total phosphates against a guarantee of 42 per cent., thus showing a serious deficiency. It is, however, only right to point out that sample No. 10, with a guarantee of 30 per cent., contains 39·1 per cent. of phosphates. Both No. 10 and No. 13 slags were manufactured at the same works, and if by some mischance the labels have become transposed, the discrepancy between the results and the guarantee would be explained.

Four of the 11 samples in which a guarantee as to fineness is given do not quite fulfil the guarantee, but the deficiency is not great in any instance.

The results show that the samples are, on the whole, fully equal to the slags which were on the market at the beginning of the War.

In bringing these results to the notice of farmers, Lord Selborne desires again to urge the importance of a more general use of basic slag for the improvement of grass land. Investigations have shown that basic slag is an effective agent of improvement over a wide range of conditions, much wider than is generally supposed.

Moreover, Professor Somerville's experiments indicate that when basic slag is used on poor grass land the increase of herbage, or of meat or milk, does not represent the whole of the benefits conferred. Concurrently with this increase there is a marked improvement in the fertility of the soil, which, in many cases, a succession of tillage crops fails to exhaust. This accumulation of fertility, due, mainly, to the stimulation of leguminous plants and other useful herbage, may prove an asset of great national importance in the event of an extension of tillage after the War. In the meantime the farmer's aim and object should be to increase the stock-carrying capacity of such land, and in basic slag he has a cheap and reasonably sure means to this end. The application of from 5 to 10 cwt. per acre of basic slag entails little labour. Slag may be applied at almost any time which is found convenient. The sooner it is applied the quicker will be the resulting benefit. Farmers, therefore, should place their orders at once, store the slag if necessary, and apply it at the first convenient opportunity. Further information on the purchase and use of basic slag will be found in the Board's leaflet No. 267, copies of which may be obtained free of charge, and post free, on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

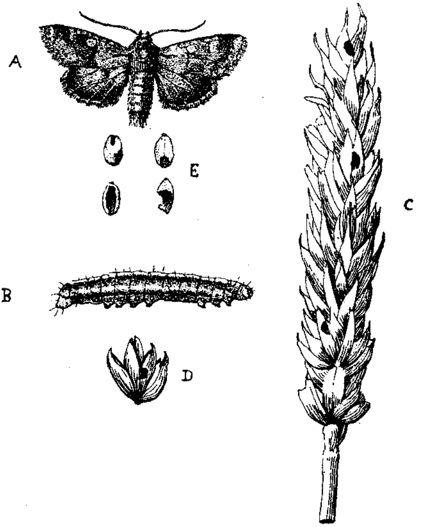
A Caterpillar on the Ears of Wheat.

THE following note has been communicated to the Board by W. Somerville, M.A., D.Sc., Sibthorpian Professor of Rural Economy in the University of Oxford:—

In August, 1915, when harvesting small experimental plots of wheat on ground attached to the School of Rural Economy, Oxford, it was found that in many cases the grains had been entirely or partially emptied of their contents. The cause of the damage was proved to be the caterpillar of the Rustic Shoulder-knot Moth (*Hadena basilinea*, also known as *Trachea* or *Apamea basilinea*). In autumn this caterpillar is ½ to 1 in. in length, pale brown in colour, with a whitish line along the back, and yellowish lines on each side. The spiracles are situated in a pale zone, bordered above by a darker line. Two black tubercular dots are placed obliquely on the side of segments 3-12. The head and segment immediately behind are pale brown and shining. Black dots, from each of which springs a stiff hair, are irregularly disposed over the body (see Fig., p. 237).

The life history is as follows: The eggs are laid in June, and from these the caterpillars emerge in a fortnight or so. These probably live for the most part on grass, but if wheat is available

they ascend the stems and feed on the ears, not only when the grains are "milky" but also when quite ripe and hard. Feeding occurs almost entirely at night, and during the day the caterpillars conceal themselves beneath the surface of the ground. In August and September they go deeper into the soil, where they pass the winter, and next spring they proceed to feed on the leaves and stems of cereals and grasses. Pupation takes place in May or June, shortly after which the moth appears.



A—*Hadena* (*Apamea*) *basilinea* ♀, slightly magnified.
B—The larva, one-half larger than life.
C—Ear of wheat, showing three places where larva has attacked.
D—Spikelet of wheat, showing hole made by larva.
E—Wheat grains, showing characteristic damage.

This insect has a very wide geographical distribution, being found all over the United Kingdom, as well as in Northern and Central Europe and in Asia as far east as Japan, while a variety (*finitima*) occurs in Canada, and in the Eastern and Central districts of the United States.

There seems to be no record of *Hadena basilinea* doing appreciable damage in this country; but Taschenberg wrote

some 30 years ago of important damage to growing cereals and maize in France, Silesia, and Bohemia, where he had seen great numbers of the caterpillars in the bottoms of harvest carts, as well as in stacks and granaries.

It is not suggested that there is any cause for alarm in this country, but the fact that the insect has done appreciable damage in Oxford, and appears to be greatly on the increase on the Continent, suggests that a sharp look-out should be kept for it in British wheat fields. Vol. I. (1913) of the "Review of Applied Entomology" contains only a single reference to this insect; a statement from a Russian bulletin is quoted to the effect that "There were complaints from many localities that the caterpillars of *Trachea basilinea* were damaging wheat in the fields, as well as in the sheaf." Vol. II. (1914), on the other hand, contains many references to serious damage. Thus, p. 41, "*Trachea* (*Hadena*) *basilinea*, Schiff., is very frequently found in Russia in ricks of unthrashed grain, and in stores, and often does great damage. . . . During the harvest time most of the caterpillars fall from the ears to the earth, but in the evenings they get back to the sheaves remaining in the fields, and in this way they get into the ricks and barns." At p. 198, "In the province of Akmolinsk larvæ of *Agriotes* and *Trachea* (*Hadena*) *basilinea* have appeared in enormous numbers." At p. 453, in an abstract of an account in the *Wiener Landw. Zeitung* of an infestation, it is stated that "This species (*basilinea*) has not been recorded near Vienna as a pest since 1855. . . . Damage due to the same species is recorded in France, Silesia, Bohemia, and Eastern Europe, and the insect is widespread in Central Europe, but does much less damage there than in Denmark and Sweden." At p. 482, "From Bohemia, complaints have been recorded of a new pest of cereals, *Trachea* (*Hadena*) *basilinea*." In the face of this evidence one cannot ignore the possibility of the insect proving troublesome in this country, and the first step towards warding off attack is to institute a careful watch for the appearance of the pest in our fields.

THE following note has been communicated to the Board by Mr. A. Roebuck, Assistant Lecturer in Botany at Harper Adams Agricultural College, Newport, Salop:—

A Bad Attack by the Mustard Beetle on Watercress.

For some years past the watercress beds on a Shropshire farm have suffered severely from the attacks of the mustard beetle (*Phædon cochleariæ*), the cress plants being thickly covered with grubs or beetles from May to the

end of the year, so that the leaves were completely stripped off and even the outer layers of the stems were also eaten away. The grubs occur only on the plants in the beds, but the beetles, in addition to occurring in dense clusters on the shoots standing out of the water, are also found all over the sides of the beds and in the field and hedges round about. They shelter in crevices of bark and in hollow-stemmed weeds through the winter. On the slightest alarm the beetles drop to the ground.

The insects cause considerable monetary loss by seriously curtailing the cropping season. The cress on this farm is grown for marketing from March to June.

The general progress of attack is as follows: The first sign is the arrival on the beds of the beetles at the end of April or beginning of May. They have in the great majority of cases walked the short distance across the field (1 to 20 yd.) from their winter shelters under loose bark, crevices of palings, hollow stems of weeds, etc. Towards the end of May the cress leaves begin to vanish rapidly and the plants become covered with large numbers of the grubs, which soon render further cropping impossible. Few beetles are seen about the end of May, but more appear in June, and from then to the cutting back of the plants both beetles and grubs abound. Although there is considerable overlapping, apparently there are at least two broods on the cress during a season, the beetles of the first brood appearing approximately in the middle of June and those of the second towards the end of July.

By the beginning to the middle of July, when most of the beds have had the plants finally cut back for new shoots to form, the larvæ have all left the beds and the beetles move into the field and hedgerows. The pupæ may then be found in little holes in the banks above the surface of the water, especially round the roots of grasses. The beetles soon emerge from these and swarm over the beds and sides until these are cleaned out. They are to be found during the autumn dotted over the ground or clustered on various plants, chiefly on the hedge side of the beds, but as the cold weather appears they take up their more sheltered winter quarters.

The beds may be divided into upper, middle, and lower series, and two other beds standing to the side of these series. These collectively form four more or less detached or independent series.

At the end of July, 1914, the large upper bed was surrounded with cut weeds, etc., and then flooded for some days while the beetles were crowded on the plants. Those beetles that escaped

mainly sheltered in the rubbish around, which was then burnt. During the autumn much of their shelter in the hedges, weeds, etc., was removed and burnt. In 1915 only the bed previously flooded was used for cropping in the upper series, the others having been cleaned out and left. This bed cropped well and was not troubled till July, when the insects had probably migrated from the middle series.

The lower series were under water owing to natural overflowing during the first part of the season 1915. This resulted in the delaying of the crop a week or ten days, but these beds were completely free from attack during the cropping season, only a few beetles having reached the beds by 21st July.

The side series and the middle series developed the attack in the usual manner. When the grubs appeared in the side series the beds were flooded. The grubs on the plants still jutting out of the water were shaken off, and then after two days the water was run off. These beds were then free from attack and were continuously cropped until the middle of July. The middle series remained untouched the whole season and were soon valueless, and spread the attack by the end of July to all the other series.

For treatment to be effective it is imperative that it should be made over the whole series, and it seems probable that if the following measures be taken the beetle may be so held in check that it is no longer a serious pest:—

(1) On the appearance of the beetles for egg-laying in May the beds should be flooded, the plants being stirred continually to keep the beetles in the water. Rubbish should be put round the beds to catch the escaping beetles. The beetles usually collect at one end, when they can be taken off in buckets and destroyed. After a final stirring of the plants the water may be run off and the rubbish around burnt.

(2) Should any larvæ make their appearance towards the end of the month the beds should again be flooded to get the grubs to the surface of the water and away from their food for a few days. After about a week the water may be run off.

(3) If the beetles collect on the beds in July another flooding would be necessary. Where the sides project above the flood-water they should be pared about one inch to throw any contained pupæ into the water. Cut weeds and old cress stems put round the beds collect large numbers of beetles. These may then be burnt or buried deeply. The beetles may again be taken out in buckets. After about a week the water may be run off. This will kill also the pupæ in the sides of the bank.

FIG. 1.—Lower Series of Beds.

FIG. 2.—Cress Plants stripped of leaves, and stems eaten; view on middle series of beds on 21st July, 1915. The beetles were continually falling off while the photograph was being taken.

(4) After a severe attack attention might be given to the removal of as much winter shelter as possible. Much good might be done by cutting down the weeds, especially hollow-stemmed ones, and grasses, cutting them low down to the ground; keeping hedges trimmed and cleaned, preferably using wire fencing or good tarred palings (stakes with bark on should never be used); and not allowing the cleanings from the cress beds to lie about and rot on the ground, since the hollow stems afford admirable shelter. All these cleanings can be left for a time round the beds to collect as many beetles as possible, and then should be burnt during the winter or early spring.

Brief Description of Phædon cochleariæ.—The grubs or larvæ, which appear on the plants in large numbers from May to July, are of a smoky-brown colour, somewhat hairy and spotted with black. They have six legs towards the head end and a caudal foot or pro-leg. When full grown they are not quite a quarter of an inch long. They are widest about the middle of the body, tapering towards each end. Along each side is a row of tubercles, from which they can protude a yellow gland.

The pupa, formed at the last moult of the larva, is bright yellow in colour, with a row of blue spots down the centre of the back. The body is broader and slightly shorter than the larva and is slightly curled in on the underside. The small undeveloped wings and legs can be seen tucked in on the underside. These pupæ are hidden just under the surface of the soil around the sides of the beds.

The perfect insect is a shining blue or green beetle of an oblong-oval shape and about one-sixth of an inch long. The thorax and wing cases are minutely punctured, the latter in lines parallel to the length of the body. These can only be seen under a magnifying glass. The antennæ, legs, and undersurface are black.

Some specimens of *Phædon armoraciæ* were also taken from the beds.

Wasps.

WHILE it is doubtless true that wasps do much good by the destruction of other harmful insects, it is equally true that when they are present in large numbers they may be responsible for considerable damage. They often ruin large quantities of fruit, while the chance disturbance of their nests in the harvest field and alsewhere may at any time be answerable for runaway horses and the accidents which follow.

It is necessary, therefore, that steps should always be taken to keep their numbers within reasonable bounds. Reports which are reaching the Board from various sources all point to the fact that an unusually large number of queens has been observed this spring, and it is therefore to be expected that wasps will be proportionately abundant and troublesome later in the season.

Methods for the destruction of wasps and their nests are too well known to need more than brief reference. The capture of queen wasps in the spring is always desirable, and is encouraged in many districts by the offer of a small reward. It may also be of interest to note that the "traps" containing beer and sugar, etc., which are found so effective later against the worker wasps, have also this season accounted for large numbers of queens.

The destruction of queen wasps, however, is not likely to have been carried out sufficiently widely to prevent the production of an abundance of workers in the near future, and it would therefore be well if nests could be marked down as early as possible so that they may be dealt with before they have become "strong." Various means are employed in taking the nests. Some prefer the old-fashioned remedies, such as tar, paraffin or burning sulphur. In many districts, however, the use of potassium or sodium cyanide has become general, and is, undoubtedly, most effective. These poisons are employed in different ways, according to individual preference and the position of the nest. As a rule, a little is placed inside the entrance to the nest after the wasps have returned in the evening. The hole is then blocked up, and further trouble is seldom experienced, though, to make sure, the nest is sometimes dug out after the adult wasps have been killed. When using cyanide, however, it should never be forgotten for an instant that this substance is one of the most deadly poisons known, a minute dose being fatal. If common sense is exercised there should be no danger, but the carelessness with which it is often treated makes this warning very necessary.

Swine Fever.*

SWINE FEVER is a contagious disease. It is caused by a living and infective agent which is so small that it cannot be seen by the highest powers of the microscope. That it is a living agent is proved by the fact that if liquid containing infective material be passed through a fine bacteriological filter a very small amount

* This article is a reprint of the Board's Leaflet No. 29, as recently re-written.

of the filtrate will produce the disease in a pig into which it has been injected, and the infecting agent will increase in its system to such a degree as to provide enough material to infect more than a thousand other pigs.

Animals which suffer from the Disease.—The pig is the only animal which suffers from swine fever, but within certain limits, which are not very wide, some pigs are more resistant to infection than others. As a general rule it may be said that young swine are less resistant than older animals, and that they suffer more severely when attacked by the disease. It must not be assumed, however, that older pigs do not take swine fever. They very frequently do, and in some outbreaks the mortality amongst the breeding stock is nearly as high as in the young pigs.

Incubation Period.—In every contagious disease there is an interval between the time of infection and the appearance of the symptoms of the disease; this is called the incubation period. During this period the infecting agent is growing in the system of the animal and producing poisonous substances and alterations of tissue, which eventually give rise to the symptoms. In swine fever the incubation period is usually about five days, but it should not be expected that in every case infected animals will be distinctly ill in this time. Some of them may not show outward symptoms until about ten days after infection, but, notwithstanding this, if their temperature be taken with a thermometer, it will be found to be higher than usual.

Symptoms.—The affected animals show marked want of appetite, and it is said that "they do not come up to the trough." They shiver, and bury themselves in the dry litter, or if there is no litter, they may lie up in one corner of the sty. Sometimes they vomit at the commencement of the disease. If the temperature be taken it will be found to register from 104° to 107° Fahrenheit. There may be a purple rash on the skin of the ears, belly, and hock; diarrhœa is generally present. The animals gradually get weaker, and, when made to move, they stagger about the sties in a drunken fashion; finally, they become unconscious, and die.

The duration of the disease varies considerably, but pigs seldom die within ten days after natural infection. More commonly they die from an acute attack of the disease after fifteen days. A considerable number, however, may live for thirty days, and in some cases pigs affected with swine fever may live as long as eighty days.

A noticeable symptom in the more chronic form of disease is great thirst, and the pigs may often be seen and heard sucking

up the drainage from the floor of a wet sty. They are also inclined to eat all kinds of filth in preference to the ordinary food—generally displaying a morbid appetite. Another noticeable symptom of swine fever in the chronic form is swelling of the joints.

The symptoms vary in degree according to the activity of the infecting agent. In some outbreaks, for example, outward symptoms amount to very little more than an appearance of unthriftiness in a number of the pigs. The fact that deaths may not occur in such cases often misleads the owner regarding the true nature of the trouble, which may be hidden by symptoms of inflammation of the lungs (pneumonia) giving rise to breathlessness and panting. The appearance of pneumonia in several pigs may, in fact, be the first important indication of the existence of swine fever. In other cases pneumonia may attack, and carry off, animals which are recovering from mild attacks of swine fever. There is no disease of swine except swine fever in Great Britain which as a general rule gives rise to so many deaths at short intervals, or to continued unthriftiness amongst a number of swine. Taking one outbreak with another the average death-rate is about 30 per cent. It may, however, be much lower than this, or it may amount to 100 per cent. of the pigs on the premises.

In short, pig owners should suspect swine fever under the following circumstances: (1) When a number of pigs are dying; (2) when a number of pigs are sick or unthrifty; (3) when periodic deaths are taking place, even if the other pigs appear healthy; (4) when large numbers of deaths are taking place in sucking or newly-weaned pigs, even if the older ones appear to be healthy; (5) when a number of pigs are sick or dying with symptoms of inflammation of the lungs, diarrhœa, or what may appear to be acute swine erysipelas ("Diamonds"); (6) the fact of suspicious symptoms appearing first in pigs which have been recently purchased, or those which have been off the premises to a market, and have been brought back, should increase the suspicion. Careful inquiry, however, into the circumstances in connection with a number of outbreaks shows that the fact of no new pigs having been brought on to the premises for some months does not of itself justify a definite opinion that an outbreak of disease is not swine fever.

Post-mortem Appearances.—The carcasses of pigs which have died of swine fever may be emaciated, and purple patches may be present on the skin of the ears, belly and hocks. In the acute cases characterised by death after a short period

of illness, redness of the lymphatic glands is observed, there are signs of inflammation on the inner lining (mucous membrane) of the intestines, while the membrane is often dotted over with innumerable small red blood spots. These spots (hæmorrhages), however, are not peculiar to the very acute forms, but may also be seen in the more chronic cases. In the latter cases one finds a deposit in the form of a yellowish membrane on the inner surface of the intestines. The most typical lesion is the swine fever ulcer, which is most commonly found in the large bowel about the junction of the end of the small bowel (ileum), and blind gut (cæcum), but swine fever ulcers may also be found much more rarely in the throat, on the tongue, and on the skin. In examining the intestines of sick animals which have been killed for purposes of diagnosis, it must be borne in mind that it does not follow that the disease is not swine fever because the typical ulceration and deposit are not found. The experimental inquiries conducted by the Board have shown that many animals may have a slight attack of swine fever and recover in a little more than ten days. If cases of this description be examined in the stage of fever, nothing more may be found in the bowel than slight redness or surface sores on the folds of the mucous membrane. The most common form of ulcer is about the size of a three-penny piece. Its edges are circular, and raised above the membrane. Its centre is soft and either yellow or black in colour. Congestion of the mucous membrane of the bowel should always be looked upon with suspicion, and particularly if it is combined with inflammatory symptoms in the lungs.

The Infective Material and how Infection Spreads.—The blood of pigs suffering from swine fever contains a large amount of the infective agent, and as the blood flows through all the organs and tissues, they also contain it. All the discharges contain the infective agent to a greater or less extent, and the intestines showing ulcers are particularly dangerous. Healthy pigs acquire the disease by mixing with affected pigs. The latter through their excretions infect the troughs or the ground and litter, and the healthy animals are infected by swallowing, or licking up, contaminated material. Infected material can be carried on the boots and clothes of attendants or castrators to neighbouring establishments, but it is mainly by affected pigs that the disease is spread from one part of the country to another. In this connection what has already been indicated might be repeated here with advantage: (1) Unthrifty pigs may have swine fever without showing definite symptoms of the disease, and may be moved to other premises in the belief that

they are suffering from some trifling and non-contagious disease; (2) some pigs may have apparently recovered from swine fever, although they are suffering from the disease in a very chronic form, and such pigs may be infective to others for a period of as long as eighty days or even more. In the majority of cases, however, such pigs show a certain amount of unthriftiness, and very frequently they are stunted.

Prevention.—It may be stated at the outset that the more sanitary the condition of the premises (*see* Leaflet No. 121—*Construction of Pigsties*) the better will be the chance of preventing swine fever, once it is introduced, from spreading rapidly through the pigs in different sties. For those who buy pigs in markets, however, or who are dependent on other people in any way for their supplies, it must not be thought that the possession of sanitary premises is any safeguard against the introduction of the disease. Precautionary measures may be tabulated as follows:—

(1) Pigs which have been recently purchased, or which have been off the premises to a market and brought back again, should be kept isolated from the others for about a month, and carefully watched; the same rule applies to sows which have been to the boar and to pigs which have recently been cut by a practising castrator.

(2) In the event of suspicious symptoms of swine fever appearing in pigs on any part of the premises, pigs therein should, if possible, be kept rigidly isolated from the others, and have separate attendants who should wear special boots and overalls while going about the sties. If, however, the existence of disease is confirmed by the Board, and the owner agrees to adopt the serum treatment (see later), it may be considered advisable to mix the ailing pigs with the healthy after the latter have received a protective dose of serum.

(3) If there are rats on the premises, an effort should be made to reduce their numbers (see Leaflet No. 244, *The Destruction of Rats*). This is advisable, not because rats suffer from swine fever, but because it is possible that they may convey infected material from one sty to another.

(4) Serum treatment is now known to be very valuable in saving the lives of pigs on infected premises, provided owners report at an early stage, and the veterinary inspector of the Board has the opportunity of applying the treatment to those pigs which are not in the grip of swine fever at the time of his visit. Treatment by serum is dealt with in a special "NOTICE TO OWNERS OF PIGS—A. 28/a," which is obtainable from the

Board, and veterinary inspectors of the Board when dealing with outbreaks have been instructed to supply owners with further information on the subject should it be required.

NOTE.—Swine fever is a disease scheduled under the Diseases of Animals Act, 1894, and the existence or suspected existence of the disease must be notified to the police (or proper authorities) in accordance with the provisions of the Swine Fever Order of 1908. Copies of this Order can be obtained free of charge on application to the Board.

Blackquarter, Quarter Ill, or Black Leg.*

BLACKQUARTER is a bacterial disease caused by the blackquarter baccillus.

Distribution.—Although blackquarter is known to have occurred in many parts of Great Britain for a great many years, no statistics of the number of animals which become affected annually, or of the districts in which it is prevalent, are available, as the disease has not been scheduled under the Diseases of Animals Act. The disease appears to be very irregularly distributed, and even on the same farm it may occur in some fields and not in others. The danger of infection is greatest on permanent pasture and on uncultivated land, and often disappears when the land is drained, and cultivated. Although low-lying, damp land is more favourable to the disease it is also found on high land. The disease is usually prevalent in the early spring and summer, but it also occurs to a less extent at other times of the year.

Animals which Contract the Disease.—Cattle and sheep are the only farm animals which become affected in Great Britain. Cases have been recorded of horses and swine dying from blackquarter, but these animals can be disregarded for all practical purposes.

In this country cattle are the principal sufferers from the disease, the mortality ranging from 2 to 20 per cent. of the total young cattle on infected farms. There are, however, certain districts in which great numbers of sheep are attacked, notably Romney Marsh, where death-rates of from 2 to 40 per cent. have occurred on certain farms in certain seasons. In the case of Romney Marsh this high mortality in sheep is probably not due to any peculiar character of the bacillus found in the locality, but to the custom of grazing sheep during the spring and summer to the exclusion of cattle.

Cattle usually become affected between the ages of 6 and 18

* This article is a reprint of the Board's Leaflet No. 102, as recently re-written.

months. Although calves under 6 months are susceptible they seldom contract the disease. Cattle above 2 years are rarely affected, and it may be said that they become less susceptible with advancing age.

The Bacillus of Blackquarter.—The bacillus is usually rod-shaped, but it may also assume the form of a drum-stick or a racket.

As it can maintain its existence in the soil, apart from a living animal body, it is called a "soil" organism. The bacillus forms spores, and in this resting stage resists great variations of temperature, and retains its activity for long periods.

Symptoms.—The period of incubation is usually about three days, but in some cases it may be five days.

In *cattle* the earlier symptoms are sometimes not characteristic, and diagnosis is difficult, but as the disease progresses distinctive symptoms appear, and in districts where it is prevalent most farmers recognise them.

In the early stages the symptoms are dullness, cessation of rumination, loss of appetite, high temperature, harsh and staring coat, trembling, and coldness of the legs, feet and horns. Later, stiffness, lameness, and arching of the back are also noticeable. On closer examination the characteristic blackquarter swelling may be observed under the skin on those parts of the body covered by thick layers of muscle, such as the upper leg, loin, buttocks, shoulder, chest or neck. The swellings also sometimes affect the tongue, throat, dewlap, genital organs or mammary glands, but are never seen below the knee or the hock, or on the tail. They are at first hot and painful, but rapidly become cold and painless, and in prolonged cases they may even become hard and parchment-like. On pressing the swelling a crackling noise, due to the formation of gas by the bacilli in the tissues, is heard.

As the disease progresses more gas is produced in the swellings, respiration becomes hurried, the animal is greatly distressed, and the temperature may rise to a high point. The pulse is rapid and feeble, and tympanitis (hoven) may be present. Dung, which may be blood-stained, is passed involuntarily. Towards the end the animal usually lies motionless, the temperature rapidly falls, and death follows.

The disease usually lasts from 12 to 48 hours, but in some cases it may be prolonged for 4 to 10 days. The swelling is not apparent in every case, as it occurs in the more deeply-situated muscular tissues. In the absence of the characteristic swelling, colic, or digestive disturbance may be the most apparent symptom, or there may be lameness and stiffness.

In *sheep* the course of the disease is not so prolonged as in cattle. Death usually occurs without symptoms of ill-health being noticed. Sometimes a sheep is seen to falter, fall to the ground, and die in a few moments. In some cases, however, symptoms of the disease are displayed for a considerable time before death occurs. The affected sheep stands stiffly with feet together, back arched, champs its jaws, and breathes heavily. Diarrhœa may be present with blood-stained excreta, and a frothy blood-stained discharge from the nostrils may be seen.

Swellings on the body may occur as in cattle, but they are not so apparent.

Post-mortem Appearances.—In *cattle* the carcass is usually very distended with gases, and blood-stained froth may be discharged from the mouth, nostrils, and anus. As a rule the characteristic swelling is also present. When pressed, the swelling emits a crackling sound due to the presence of the gas, and if it is cut a blood-stained fluid, possessing a typical rancid odour, distinct from the putrid odour given off by a decomposing carcass, exudes from the cut surface. Owing to the formation of gas the muscular tissue appears to be dark red, almost black in colour, and porous looking. The blood in the vessels clots and is generally normal in appearance. In some cases lesions are absent in the superficial muscular tissues, but they are usually to be found elsewhere in the carcass.

In *sheep* the muscular lesion is the same as in cattle, but it is not so noticeable. It may be found almost anywhere in the carcass, but is usually present in the upper parts of the limbs, On a close examination of the carcass of a sheep which has died of blackquarter it will usually be found that some part of the carcass is swollen; the fleece overlying the swollen portion pulls away easily, and the skin so exposed is of a dark purple colour. The characteristic crackling of gas is heard if the swollen part is pressed, and if the swollen part is cut into, the appearance is identical with the cattle lesion. Even in districts where blackquarter is prevalent, stockowners should always bear in mind the possibility that an animal which has died after a short illness, or has been found dead, may have died of anthrax. If an animal has shown symptoms of blackquarter during life, and the characteristic swelling distended with gas is also present after death, stockowners would be justified in forming the opinion that death was due to blackquarter, but, if these characteristic signs are not present, it is possible the animal may have died of anthrax.

Infective Material and Method of Infection.—The spores

may remain active in the soil for years, but their number may be added to by material from new cases, especially if infected carcasses have been cut up on the pastures. The flesh and fluid of the swellings contain highly infective material, and the same applies to the blood-stained discharges. Animals do not infect each other directly, but pick up infection from the soil either by swallowing infected food or by contaminating a wound.

Prevention.—As the spore is capable of living in the soil, the greatest care should be exercised to prevent any addition to the number of bacilli already in the soil by the careless disposal or unnecessary cutting up of the carcass. An animal which has died from the disease should not be skinned, as the small amount received for the pelt is out of all proportion to the risk which is run of further infecting the farm.

All carcasses should be properly buried or burnt, especially in the season of castrating and docking.

Several methods of inoculating young stock to protect them against the disease are in use in different parts of the world. Arloing's method consists of two injections of vaccines at an interval of ten days, and it gives the inoculated animal immunity against the disease for about one year. Unfortunately, fatal accidents may follow the operation. The deaths do not amount to much—under 1 per cent. if reckoned on a large number of animals—but, since many deaths may occur on one farm, or in the same district, this form of inoculation should not be adopted unless the losses from the disease are annually very high. A safer method of protection is to use a serum together with a dose of pure culture of the bacillus. Before adopting preventive inoculation the owner of an infected farm should consult a veterinary surgeon who can advise him whether the annual losses from the disease make it worth the attendant risks. The choice of the method of vaccination and the age at which the animals should be treated should be left to the veterinary surgeon, who probably knows which method has been most successful in the district.

Treatment.—No form of medical treatment has been discovered which can be relied on to cure blackquarter. Certain remedies have been widely advertised, but they have all proved valueless. Some success has been claimed in the past for the method of treatment which consists of incising the swellings and dressing the wounds with antiseptics. This method, however, is now seldom adopted, for, if the patient recovers, as it very rarely does, a large area of tissue sloughs, and the convalescent period is, in consequence, long and expensive to the owner.

Notes on Feeding Stuffs in June: *From the Animal Nutrition Institute, Cambridge University.*

Prices of Feeding Stuffs.—The changes in prices are this month very irregular. Most feeding stuffs have risen in price, and in some cases the rise is considerable. For instance, linseed cakes, cotton cakes, wheat sharps, feeding treacle, and Burmese rice meal, are dearer than last month by between 2*d*. and 3*d*. per unit. Wheat offals (with the exception of bran), maize and maize products, oats, beans, ground nut cake, palm-nut kernel cake, soya bean cake, and coconut cake are all slightly dearer than last month.

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of May.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soya Bean Cake	122·3	11	10	0	11	5	0	12	0	0		—	
Decorticated Cotton Cake	126·3	13	2	6	13	5	0	12	10	0		—	
Indian Linseed Cake ..	123·1	12	2	6	13	7	6		—			—	
English Linseed Cake ..	120·1	12	12	6	14	0	0	12	10	0	12	17	6
Bombay Cotton Cake ..	65·3	9	15	0	9	15	0	9	15	0	9	17	6
Egyptian Cotton Cake ..	71·9	9	17	6	10	15	0	10	5	0	10	7	6
Coconut Cake	102·6	10	10	0	10	5	0		—			—	
Palm-nut Kernel Cake ..	90·5	9	0	0	7	15	0	8	0	0	9	2	6
Ground-nut Cake ..	145·2	*11	15	0	10	10	0	12	0	0	11	15	0
English Beans	99·5	12	0	0	13	10	8		—		12	4	3
Chinese Beans	101·2	11	18	0	12	16	8		—			—	
English Maple Peas ..	97·2	12	17	9		—		14	8	10		—	
English Dun Peas ..	97·2	12	2	3		—		12	17	9		—	
Calcutta White Peas ..	97·5		—			—		16	17	9		—	
American Maize	93·8	12	5	0	12	4	6		—			—	
Argentine Maize	94·2	12	5	0	12	5	6	12	2	8	12	14	4
Maize Meal	86·5	12	0	0	13	5	0	13	5	0	12	15	0
Maize Gluten Feed ..	121·6	11	5	0		—			—		11	15	0
Maize Germ Meal ..	99·2	11	12	6	12	15	0		—		12	5	0
English Feeding Barley ..	83·0		—			—		12	12	0	13	3	2
English Oats	75·4	12	10	0	12	17	3	11	16	8	12	6	8
Argentine Oats	75·4	12	17	11		—			—		12	10	6
Malt Culms	69·9	7	10	0	8	10	0	6	0	0	8	0	0
Brewers' Grains (dried) ..	84·5	8	7	6		—		8	10	0	9	0	0
,, ,, (wet) ..	21·1	1	2	0		—		1	10	0		—	
Distillers' Grains (English)	101·2	9	0	0	9	0	0		—		10	5	0
,, ,, (French)	101·2	8	17	6		—			—			—	
Egyptian Rice Meal ..	78·7	10	10	0		—		10	5	0		—	
Burmese Rice Meal ..	78·7	9	10	0	9	15	0		—		10	15	0
Wheat Middlings (coarse)	93·4	10	0	0		—		8	15	0	11	0	0
Wheat Sharps	86·3	10	5	0	10	5	0	10	5	0	10	10	0
Wheat Pollards	81·9		—		8	0	0		—			—	
Wheat Bran	77·5	7	7	6	7	5	0	7	5	0	7	10	0
Wheat Bran (broad) ..	79·9	8	10	0	8	0	0	8	10	0	8	5	0
Feeding Treacle	60·0	†14	0	0	13	17	6		—			—	
Linseed	153·5	20	0	0	‡26	0	0	20	12	0	20	1	2
Linseed Oil	250·0	35	10	0	§45	0	0	34	12	6	49	15	7
Egyptian Cotton Seed ..	108·6	14	5	0		—		14	5	0		—	
Bombay Cotton Seed ..	99·6		—			—			—			—	
Cotton Seed Oil	250·0	45	10	0	§55	0	0		—			—	

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	0½	Wheat sharps	2	4½
Ground nut cake ..	1	7½	Burmese rice meal ..	2	5
Distillers' grains (French)	1	9	*English beans*	2	5
,, ,, (English)	1	9¼	English dun peas ..	2	6
Maize gluten feed ..	1	10¼	Argentine maize ..	2	7¼
Soya bean cake	1	10½	American maize.. ..	2	7¼
Wheat bran	1	10¾	Linseed	2	7¼
Palm-nut kernel cake ..	1	11¾	Egyptian cotton seed ..	2	7½
Brewers' grains (dried) ..	1	11¾	English maple peas ..	2	7¾
Indian linseed cake ..	1	11¾	Egyptian rice meal ..	2	8
Coconut cake	2	0½	Egyptian cotton cake ..	2	9
Decorticated cotton cake	2	1	Maize meal	2	9¼
English linseed cake ..	2	1¼	Linseed oil	2	10
Wheat bran (broad) ..	2	1½	Bombay cotton cake ..	2	11¾
Wheat middlings ..	2	1¾	English oats	3	3¾
Malt culms	2	1¾	Argentine oats	3	5
Maize germ meal ..	2	4	Cotton seed oil	3	7¾
Chinese beans	2	4¼	Feeding treacle	4	8

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	5¼	Chinese beans	2	6½
Palm-nut kernel cake ..	1	8½	Maize germ meal ..	2	6¾
Distillers' grains (English)	1	9¼	Argentine maize ..	2	7¼
Soya bean cake	1	10	American maize.. ..	2	7¼
Wheat bran	1	10½	English beans	2	8¾
Wheat pollards	1	11½	Bombay cotton cake ..	2	11¾
Coconut cake	2	0	Egyptian cotton cake ..	3	0
Wheat bran (broad) ..	2	0	Maize meal	3	0¾
Decorticated cotton cake	2	1¼	Linseed	3	4¾
Indian linseed cake ..	2	2	English oats	3	5
English linseed cake ..	2	4	Linseed oil	3	7¼
Wheat sharps	2	4½	Cotton seed oil	4	4¾
Malt culms	2	5¼	Feeding treacle	4	7½
Burmese rice meal ..	2	5¾			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	Egyptian rice meal ..	2	7¼
Ground nut cake ..	1	7¾	Egyptian cotton seed ..	2	7½
Malt culms	1	8½	English dun peas ..	2	7¾
Palm-nut kernel cake ..	1	9¼	Linseed	2	8¼
Wheat bran	1	10½	Linseed oil	2	9¼
Wheat middlings ..	1	10½	Egyptian cotton cake ..	2	10¼
Soya bean cake	1	11½	English maple peas ..	2	11¾
Decorticated cotton cake	1	11¾	Bombay cotton cake ..	2	11¾
Brewers' grains (dried) ..	2	0¼	English feeding barley ..	3	0½
English linseed cake ..	2	1	Maize meal	3	0¾
Wheat bran (broad) ..	2	1½	English oats	3	1¾
Wheat sharps	2	4½	Calcutta white peas ..	3	5½
Argentine maize	2	7			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	7½	Maize germ meal ..	2	5½
Wheat bran	1	11¼	Linseed	2	7¼
Maize gluten feed ..	1	11¼	Argentine maize ..	2	8½
Palm-nut kernel cake ..	2	0¼	Burmese rice meal ..	2	8¾
Distillers' grains (English)	2	0¼	Egyptian cotton cake ..	2	10¾
Wheat bran (broad) ..	2	0¾	Maize meal	2	11½
Brewers' grains (dried) ..	2	1½	Bombay cotton cake ..	3	0¼
English linseed cake ..	2	1¾	English feeding barley ..	3	2
Malt culms	2	3½	English oats	3	3¼
Wheat middlings ..	2	4¼	Argentine oats	3	3¾
Wheat sharps	2	5¼	Linseed oil	3	11¾
English beans	2	5½			

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	2¾	Burmese rice meal ..	2	6½
Ground nut cake ..	1	7	English beans	2	6½
Distillers' grains (French)	1	9	English dun peas ..	2	6¾
Distillers' grains (English)	1	10¼	American maize.. ..	2	7¼
Palm-nut kernel cake ..	1	10½	Egyptian cotton seed ..	2	7½
Soya bean cake	1	10½	Egyptian rice meal ..	2	7½
Wheat bran	1	10¾	Argentine maize ..	2	7½
Maize gluten feed ..	1	10¾	English maple peas ..	2	9¾
Wheat pollards	1	11½	Linseed	2	10
Coconut cake	2	0¼	Egyptian cotton cake ..	2	10½
Decorticated cotton cake	2	0½	Maize meal	2	11½
Brewers' grains (dried) ..	2	0½	Bombay cotton cake ..	2	11¾
Indian linseed cake ..	2	1	English feeding barley ..	3	1¼
Wheat bran (broad) ..	2	1	English oats	3	3½
Wheat middlings ..	2	1½	Linseed oil	3	3½
Malt culms	2	1¾	Argentine oats	3	4¼
English linseed cake ..	2	2	Calcutta white peas ..	3	5½
Wheat sharps	2	4¾	Cotton seed oil	4	0¼
Maize germ meal ..	2	5½	Feeding treacle	4	7¾
Chinese beans	2	5½			

A few of the less generally used feeding stuffs, such as wet brewers' grains, barley, and Calcutta peas, have fallen considerably in cost since last month, and bran, decorticated cotton cake, malt culms, and English dun peas, are slightly cheaper.

Suggested Rations for June.—*Horses* will now be accustomed to grass or green soiling, and beans, which have become dearer, may be safely withdrawn from their ration of dry food. The cheapest ration for this month is a mixture of 3 lb. of maize gluten feed and 4 lb. of bran, which has about the same food value as 8 lb. of oats.

Cows will probably not require anything this season in addition to the abundant grass, and most of them would refuse dry food

if it were offered to them. The deepest milkers, however, if they show signs of excessive loss of flesh, will probably take a mixture of linseed cake and palm-nut kernel cake up to from 3 to 6 lb. per head per day.

Young Stock which are being forced for early maturity will pay for about 2 lb. per head per day of a mixture of linseed cake, palm-nut kernel cake and bran in equal proportions.

Lambs on leguminous crops such as tares on the arable land, if intended for early mutton, may get all they will take of the mixture recommended for young stock. If they are on rape, kale, or winter barley or oats, the mixture should include ground nut cake.

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible.			Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.		
Foods Rich in both Protein and Oil or Fat.						
Ground-nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English, " " French	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake ..	1 : 4·6	12·5	7·7	39·0	69·5	90
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 5·3	12·0	3·0	56·0	59·1	78
Wheat sharps	1 : 5·0	12·0	4·0	50·0	58·4	77
Wheat pollards	1 : 5·3	11·6	3·5	53·0	54·1	71
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·7	11·3	3·0	45·4	48·1	63

THE following note has been communicated by Mr. John Hughes, F.I.C., Agricultural Analyst for Herefordshire:—

Water in Grass and Roots.

Composition of Grass.—The following analyses by the writer relate to average samples of grass obtained by cutting portions from different parts of a grazing pasture in a field in Surrey on *fine, dry days.*

Date when cut. 1915.	*Water.* *Per cent.*	*Organic Matter.* *Per cent.*	*Mineral Matter.* *Per cent.*	*Nitrogen.* *Per cent.*
21st February	69·94	27·43	2·63	1·01
21st March ..	74·22	23·64	2·14	·95
18th April ..	73·70	24·26	2·14	·78
16th May ..	76·91	20·60	2·49	·59
13th June ..	71·36	25·68	2·96	·54
1st August ..	73·70	23·69	2·61	·72
6th September	71·85	25·36	2·79	·64
3rd October ..	68·37	28·91	2·72	·69
11th November	68·59	26·36	5·05	·66
29th December	75·42	20·59	3·99	·76
Average ..	72·40	24·65	2·95	·73

The percentage of water thus varied from 68·37 per cent. in October to 76·91 per cent. in May.

A further two samples were taken by the writer in *wet weather* in December. The first, taken after a wet night, contained 84·18 per cent. of water; the second, taken on a damp, foggy morning, contained 83·06 per cent. of water; *i.e.*, the average water content of the two samples was 83·62 per cent.

Thus, during wet weather, grass contains 10 per cent. more water, and consequently 10 per cent. less dry feeding material than during dry weather.

Composition of Roots.—The following figures for water content are given by Watts and Smetham:—

	Watts. *Per cent.*	*Smetham.* *Per cent.*	*Average.* *Per cent.*
Turnips	90·57	91·51	91·04
Swedes	88·88	90·42	89·65
Mangolds	88·26	87·89	88·07

Roots are, therefore, a much more watery food than grass.

Need for Dry Food.—The above figures show that when on grass cattle and sheep obtain much less nutriment in wet weather than in fine. Hence, it is important to give them some dry food during a continuance of wet weather, especially if the latter is associated with a low temperature or cold winds.

The figures further show that when changing sheep from grass to roots there is again a transition to more watery food; hence the need for supplementing the roots with at least some good chaffed hay or crushed oats. Even when on mountain pasture affording a much drier and more concentrated food than turnips and swedes, sheep seldom drink water.

Notes on Manures in June
From the Rothamsted Experimental Station.

Swedes.—The most important manuring that remains to be done on the farm is for the swedes, notes on which were given in the *Journal* for April. The great point to remember is that the size of the dressing must be regulated by the ordinary size of the crop; if the climate restricts the crop to some 12 tons per acre there is no point in using anything but dung and phosphates, as artificial nitrogenous manures might only be wasted. On the other hand, when 20 tons or more can be grown per acre it is profitable to use not only dung and phosphates but artificial nitrogenous manures as well.

Corn Crops.—By this time the effect of the top dressings on the corn crops ought to be noticeable. Whenever the nitrogenous manure is proving effective the corn has a darker green colour than where it was not used. If no difference is visible between the corn that was top-dressed and any that was not there may still be a difference in the actual grain, but close inspection ought to be made to discern any cause of failure, so as to avoid a similar lack of result in the future. This subject was more fully discussed last month.

Hay.—The great demand for hay this year will cause the seeds aftermath to assume unusual importance. At present the first crop in many districts promises to be good, but it is absolutely essential to get as much hay as possible. Unfortunately, few, if any, experiments have been made on the aftermath, which is generally left to take care of itself; indeed, so much depends on the weather that the problem is largely out of the farmer's hands. Wherever the seeds mixture has been manured there is probably no need to do anything, especially if a complete dressing was given. Most of the experiments on the manuring of the seeds mixture show that the benefit of phosphates and potash (whenever this is necessary) extends to the aftermath; this was noticed on the seeds hay in the Durham County experiments,* the Edinburgh experiments,† in the Cockle Park experiments,‡ and in the Lancashire experiments.§ On the other hand, where nitrogen alone is given in the early parts of the season the effect is wholly exhausted by the first crop, and in the Edinburgh experiments the aftermath was considered to have suffered. Very commonly the seeds mixture has no dressing, and the

* County Councils of Cumberland, Durham, and Northumberland, 9th Ann. Rep., 1900, p. 30.
† Edinburgh and East of Scotland Coll., Bull. 13, 1907.
‡ Cockle Park, Bull. No. 19, 1913, p. 70.
§ Lancs County Council, Farmers' Bull. No. 15, 1909.

question then arises whether it is worth while giving anything now. If the mixture consists mainly of clover probably nothing can be done, but if it is largely rye grass an increase may be expected from a dressing of artificial nitrogenous manure (either nitrate of soda or sulphate of ammonia). The actual increase obtained must depend on the weather, and in a dry season might be too small to justify the expenditure; but in moister situations where the first crop was cleared off sufficiently early to allow time for the second to grow it may prove advantageous to apply a small nitrogenous dressing.

Manurial Value of certain Feeding Stuffs.—The scarcity of cotton and linseed cakes has caused farmers to make more extensive use of some of the newer feeding stuffs which, though

Manurial Value of various Cakes at present War Prices of Fertilisers.

—	Nitrogen at £1 per Unit.		Phosphoric Acid at 5s. per Unit.		Potash at 8s. per Unit.		Total Value.
	No. of Units.	Value if Half the Units is lost.	No. of Units.	Value if Quarter the Units is lost.	No. of Units.	Value if Quarter the Units is lost.	
		£ s. d.		s. d.		s. d.	£ s. d.
Decorticated Cotton Cake	6·9	3 9 0	3·1	11 7	2·0	12 0	4 12 7
Ground Nut Cake ..	7·6	3 16 0	2·0	7 6	1·5	9 0	4 12 6
Soya Bean Cake ..	6·9	3 9 0	1·3	4 10	2·2	13 2	4 7 0
Rape Cake	4·9	2 9 0	2·5	9 4	1·5	9 0	3 7 4
Linseed Cake ..	4·7	2 7 0	2·0	7 6	1·4	8 5	3 2 11
Cotton Cake, Egyptian	3·5	1 15 0	2·0	7 6	2·0	12 0	2 14 6
Cotton Cake, Bombay	3·1	1 11 0	2·5	9 4	1·6	9 7	2 9 11
Coconut Cake ..	3·4	1 14 0	1·4	5 3	2·0	12 0	2 11 3
Palm-nut Kernel Cake	2·5	1 5 0	1·2	4 6	0·5	3 0	1 12 6

well known on the Continent, are not yet widely used in the United Kingdom. The nutritive value of these substances is dealt with in the Notes on Feeding Stuffs issued monthly in this *Journal* from the Animal Nutrition Institute, Cambridge, and does not concern us here. All these cakes contain valuable manurial ingredients, and they contribute very materially to the stock of manure for the land: when a farmer buys cake for this season he is also buying manure for next. The manurial value of the cake, therefore, has to be taken into consideration in deciding what price it is worth. As prices of fertilisers have

risen the manurial value of the cake has correspondingly increased.

The list on p. 257 is calculated on the present prices of fertilisers, and it shows the value of manure obtained from one ton of each of the cakes specified, assuming that the cake is fed to mixed stock in yards under ordinary conditions. Half of the nitrogen, one-quarter of the phosphate, and one-quarter of the potash are supposed to be wasted. On an average this is probably correct, although under careful management the losses could be considerably reduced, as already shown in this *Journal* (December, 1914).*

Co-operative Use of Motor Plough by Pinvin Agricultural Co-operative Society.

WITH the growing scarcity of labour it is important to make the most effective use of all available labour-saving implements and machines. Unfortunately, the average smallholder finds that unless he can borrow the implements from a neighbouring farmer he is debarred from using them owing to the heavy initial capital expenditure incurred in purchasing them. Since the outbreak of war the position of the smallholder has been rendered more difficult owing to the inability of the farmer to render the usual assistance, with the result that many operations on the holding have had to be carried out too late in the season and the work generally has been somewhat disorganised. One of the most effective methods of avoiding this unsatisfactory state of affairs in districts where small holdings are numerous is to purchase and use the more expensive implements co-operatively. This form of co-operation has been extensively practised for some years among small farmers in the southern and western districts of Ireland, where it has been instrumental in increasing the output of the farms and improving the position of the farmers. At present there are few instances of the co-operative use of implements in England, but there are indications that smallholders are beginning to realise its advantages.

A good example of what may be done in the way of purchasing implements co-operatively is afforded by the Agricultural Co-operative Society at Pinvin, in Worcestershire. Last year, owing to the scarcity of labour and horses and the increase in the number of small holdings in the district, the members of the

* The question of the manurial values of cakes in the case of cows is discussed at length on p. 209 *et seq.*

Society found it almost impossible to get their ploughing done by neighbouring farmers as in the past. The Society decided, therefore, to take steps to purchase a Wyles motor plough to be used co-operatively by the members, and approached the Worcestershire County Council with a view to obtaining a loan of £175 for the purchase of the plough. In support of their application the Society pointed out that the land to be cultivated would probably be more than sufficient to occupy the time of the plough. The area of land then occupied by members, who were increasing in number, was 150 acres. Apart from land let by private owners, several hundred acres were let by the county council in Pinvin and two adjoining parishes, and it was concluded, therefore, that there would be no difficulty in letting the plough to non-member smallholders, if its time were not fully occupied on land belonging to members.

It was estimated that the profit and loss account for the first year would read somewhat as follows:—

	£	s.	d.		£	s.	d.
To repayment of principal, and interest at, say 5 per cent. for 8 years	26	19	7	By ploughing 200 acres acres at 15*s.* per acre	150	0	0
,, wages of man, part time	30	0	0	,, skimming 150 acres at 2*s.* 6*d.* per acre ..	18	15	0
,, petrol, repairs, etc...	56	0	0	,, scuffling 50 acres at 5*s.* per acre ..	12	10	0
,, sundry expenses ..	10	0	0				
,, balance, for reserve and contingencies ..	58	5	5				
	£181	5	0		£181	5	0

Although they fully sympathised with the proposal the County Council decided that in the present circumstances they could not see their way to make the necessary loan, and the Society, therefore, had to obtain the money from other sources. £92 10*s.* was raised by subscription and £96 from friends of the movement, the latter sum being treated as loan share capital. After paying for the plough, a stock of petrol, and for certain labour in preliminary trials there was an adverse balance of £2 11*s.* 9*d.*

The plough was not obtained in time for the autumn ploughing in 1915, and in the early part of 1916 the weather was too bad to allow of it being used very much. From the work carried out, however, the Society are satisfied that the enterprise will be successful and profitable to the members.

Agricultural Education and Live Stock Improvement in Wales.*

Position in Wales before 1912-13.—The year 1912-13 marks the beginning of a new era in the history of agricultural education in Wales, in so far as public administration and financial assistance are concerned.

Before 1912-13 a large amount of work had been carried on with regard to agricultural education; the majority of the Welsh centres were grouped into areas and affiliated to the agricultural departments of the University Colleges at Aberystwyth and Bangor. The cost of the work was practically borne by the counties themselves, no State aid being received except sums (mostly small) in the form of technical grants from the Board of Education, while the grants of the Board of Agriculture were made to the two Colleges mainly for in-college work. Certain counties were not at any time included in the areas affiliated to the Colleges, and made independent provision for agricultural education.

Owing to the smallness of the county resources, and the heavy drain upon them for other forms of education, no large expenditure by the Welsh counties on agricultural education was possible; the expenditure in the three years ended 31st March, 1912, averaged £6,184 for the whole of the Welsh counties, and of this sum Monmouth spent £2,101 and Glamorgan £1,058.

The work carried on in the counties consisted largely of courses of lectures at local centres on agriculture, horticulture, poultry management, dairying, and sometimes other subjects, such as bee-keeping and veterinary hygiene. In addition to lectures, classes for practical instruction in butter and cheese-making were conducted at different centres in most of the counties, and there was usually a considerable number of field experiments and demonstrations carried on, the results of which were communicated to farmers by means of printed reports and otherwise.

Besides the activities of the Colleges as regards work undertaken for, and in, affiliated counties, and paid for by these counties, a considerable amount of in-college work had been carried on, consisting of higher courses in agriculture and dairying as well as of short courses primarily intended for farmers' sons. The grant made by the Board was £1,200 for agriculture to each college, and an additional £250 to Bangor College for forestry work. Thus the total public assistance given to agricultural education amounted to about £9,200 per annum.

Agricultural Development in Wales since 1911–12.—The agricultural development which has taken place in Wales between 1912 and 1915 is due, directly or indirectly, to schemes financed by the Board out of the Development Fund.

To bring the Board into closer touch with Welsh agriculturists generally, and to advise the Board particularly on agricultural education and live stock improvement in Wales, the Welsh Agricultural Council

* Summarised from the Report on Agricultural Education and the Improvement of Live Stock in Wales in the years 1912–13 to 1914–15 [Cd. 8222, 2½*d.*].

was established in 1912; Mr. C. Bryner Jones joined the Board's staff as Agricultural Commissioner for Wales and became chairman of the Welsh Agricultural Council The Council consists of members nominated by the Board and by County Councils and representatives of the agricultural departments of the University Colleges; three committees have been appointed, one specially for the live stock scheme and the other two generally for the Bangor and Aberystwyth Colleges areas.

Agricultural Education.—*Development in connection with Local Education Authorities.*—Agricultural education in the counties, as distinct from the Colleges, is chiefly concerned with the farm institute scheme, the object of which is to develop the courses of instruction at local centres in agriculture, dairying, poultry management, horticulture and other subjects, together with systematic courses for farmers' sons and daughters either at institutes specially provided for the purpose or at existing institutions where facilities for such courses could be given. The liberal grants obtainable under the scheme could only be made in respect of *new expenditure*, a fact which occasioned considerable difficulties on account of the smallness of the resources of most of the Welsh counties. These difficulties prevented the farm institute scheme from becoming operative in the Welsh counties generally until 1914–15, but by this date every county had formulated a definite scheme involving, in one direction or another, new expenditure from county funds, and thus qualifying for grants from the farm institute fund. Only two counties had taken steps to provide special institutions for agricultural instruction, viz., Carnarvon and Monmouth; the eleven other counties decided to continue, for the time being at least, to work in direct association with the agricultural departments of the two Colleges as before, regarding the latter as serving them for the purposes of the farm institute scheme.

With regard to the progress of the work of organisation, perhaps the most important development is the increase in the staff specially employed for county work, which has been made possible by the additional funds now available. Of particular importance has been the appointment of resident agricultural organisers to organise and generally supervise the work locally.

Each county, through its Agricultural Committee, makes provision for its own scheme; the schemes at present in operation vary somewhat in character, but, generally speaking, include provision for the following:—

(1) Courses of instruction at local centres in the county in agriculture, horticulture, dairying, poultry management, veterinary hygiene and other subjects, conducted by a staff employed directly by the county or through the agricultural department of one of the Colleges.

(2) Field experiments and demonstrations on manuring, new varieties of crops, seeds mixtures, &c.

(3) Systematic courses of instruction in agriculture and dairying for farmers' sons and daughters, aided by scholarships and exhibitions, at either one of the University Colleges or county institutions where the latter exist.

The form in which the local instruction is given varies somewhat according to the county. Popular lectures have always been very successful in most parts of Wales; but with the new movement much more attention is given to local tutorial classes, conducted by the

county organiser or other lecturer, and extending over a period of 10 or 12 weeks during the winter months. These classes have so far proved very successful. The instructors in horticulture and the instructresses in dairying and poultry management remain in a district as a rule for a specific period, visiting farms and cottages for the purpose of giving personal information and advice, and combining this work with lectures and practical demonstrations. Classes for practical instruction in hedging and basket-making, and in horse-shoeing for shoeing smiths, have been conducted under the new scheme in counties where no such instruction had been possible before.

Finally, the provision of systematic instruction of students at some permanent institution for longer or shorter periods is an essential feature of each county scheme. This is not a new feature; but a much larger number of men and women are now given the opportunity of receiving such instruction than was the case in previous years. Every county offers, under its agricultural scheme, a number of scholarships or exhibitions to enable students to attend specially arranged courses of the farm institute type in the winter and summer. Carnarvon has a farm school of its own—the Madryn Castle Farm School—for the instruction of students of this description; this is the first farm school in England and Wales; the total contributions made by the Board in respect of the cost of building and equipment were £1,580 in 1913–14 and £700 in 1914–15.

The Board began to pay grants to local authorities in respect of the agricultural education provided by them in the school year 1912-13, the total paid then being £504; this sum consisted of the technical grants previously payable by the Board of Education. The estimated grants payable by the Board of Agriculture to the Welsh local authorities in respect of the year ended 31st March, 1915, amounted to £4,170. Adding this to the expenditure entirely out of county funds, the total estimated county expenditure reaches £12,354 as compared with the £6,184 in the three years (average) ended March, 1912.

Development in the Agricultural Departments of the Colleges.—The financial position of the agricultural departments of the Colleges has been directly improved by the new arrangements in the counties to the extent that more scholarships tenable at the Colleges are now awarded by the counties, and indirectly improved in so far as the Colleges now incur no expenditure upon purely county work, which is now fully covered by county funds.

Both Colleges became eligible for a grant, secured by the Board from the Development Fund, for the appointment of special officers to give technical advice to farmers and to investigate local problems; advisers in agricultural botany and chemistry were appointed at each college, so that it is now possible to furnish the farmer, free of charge, with technical advice as to how to deal with agricultural problems. This advisory work was extended to forestry by a grant of £500 to the Bangor College for the purpose. Further than this, grants for research work on various subjects have been made to the Aberystwyth College; and live stock officers have been added to the staffs of both Colleges, chiefly to supervise the live stock improvement scheme (see below), but also to assist and advise farmers in connection with matters relating to live stock generally.

Up to 1912-13 a grant of £1,200 was made by the Board to each College; the grants for the specific purposes indicated above, added to the £1,200, brought the total grants by the Board in 1914-15 up to £2,607 to Aberystwyth College and £4,124 to Bangor College.

The following statement shows approximately the total expenditure upon all forms of agricultural and forestry education in Wales in 1914-15 compared with the average expenditure for the three years ending 31st March, 1912:—

	Average for three years ending 31st March, 1912.		1914–15.
	£		£
Estimated Net Expenditure of County Authorities.	5,869	....	8,184
Grants from Board of Agriculture:—			
a. To County Authorities (estimated)	315	....	4,170
b. To Agricultural Departments of Colleges.	2,284	....	6,184
c. To Forestry Department (Bangor)	250	....	771
TOTAL	£8,718	....	£19,309

Live Stock Improvement.—The institution by the Board of the live stock improvement scheme was regarded with much satisfaction in Wales, and the measure received hearty support from those most directly concerned. It is certain that the agricultural prosperity of Wales depends, and must continue to depend, chiefly upon its live stock.

The total funds allocated to Wales under the scheme were £5,404, viz., for heavy horses £1,680, bulls £2,700, boars £188, and milk recording £836.

The Live Stock Committee of the Welsh Agricultural Council (referred to above) is linked up with a Live Stock Committee in each county, the chairman of the County Committee in each case being a member of the Council Committee. For the purposes of the scheme, Wales is divided up into two provinces under the charge of two live stock officers attached respectively to the Aberystwyth and Bangor Colleges.

In 1914 grants to the value of £1,532 10*s*. were awarded to 18 societies in respect of 20 heavy horses; from the beginning of 1914 to 31st March, 1915, grants to the value of £2,517 were made to 140 societies in respect of 168 bulls and to a private owner in respect of one bull; up to the same date grants were made to 30 boar societies in respect of 30 boars representing a sum in grants of £116; only one milk recording society had been formed in Wales by March, 1915.

There is ample evidence that the live stock scheme is already exerting an influence upon the breeding of live stock in Wales which, if continued for a reasonable time, will result in a benefit to Welsh farmers which can hardly be overestimated.

In conclusion, it may be mentioned that the total annual grants payable by the Board to Wales under all of the above-mentioned schemes amount to about £15,525, or an increase of some £12,900 over the amount so paid in 1911–12; even this larger amount does not represent the maximum grant which it is possible for Wales to receive under the schemes dealt with, and it is of course only a proportion of the Board's total expenditure upon Wales.

Instruction in Light Farm Work and Milking for Women and Children.

IN a considerable number of counties of England and Wales instruction in light farm work and milking for women and children is now provided by the county authorities. Full details for any county may be obtained from the Secretary for Education or the Agricultural Organiser of the county, but the following brief summary, indicating the provision being made for instruction in different counties, will prove of general interest.

Bedford.—The Agricultural Education Sub-Committee, in co-operation with the War Agricultural Committee, has prepared a scheme for the instruction of women in light farm work, as follows:—

The pupil must undertake to remain on an approved farm for a period of at least eight weeks, the first four to be regarded as a period of instruction, the pupil receiving from the Committee a maintenance grant of not more than 10*s*. per week, while during the second four weeks the farmer will pay a wage of 15*s*. per week. At the end of eight weeks the pupils may make their own arrangements as to future employment.

The scheme and rates of payment do not apply to hay-time and harvest.

Berkshire.—The training of women at the Reading University College is being continued; and classes are also being organised in different villages in the county. The Agricultural Instruction Committee in January, 1916, recommended the County Council to make a grant of £50 to the Berkshire Women and Farm Labour Committee for the purpose of training women on the lines laid down in the Board's Circular Letter of the 29th November, and for the organisation of meetings, where desirable, with the object of forming a register of women capable of undertaking agricultural work, and of farmers willing to employ such women.

Buckingham.—The Agricultural Instruction Committee have allocated a sum of £50 for the instruction of women in farm work during the year beginning 1st April, 1916.

Cambridge.—The Agricultural Education Sub-Committee have made provision in their estimate of expenditure for 1916-17 for the training of women in agricultural work. Arrangements have been made for teaching a number of women to milk, while classes are being organised at the Cambridge University Agricultural Department's farm in general farm work.

Cheshire.—The Education Committee has arranged one free course of training at the Worleston Institute. The course lasted for 2 months, and 11 students were trained. For the first month the Board made a grant of £2 per head, and for the second month were responsible for two-thirds of the cost of training. In addition, about 20 students were trained at Worleston at their own expense. Further arrangements for training have been made at the Henhull Hall Farm, which is the property of the County Council. In this course six students are being taken for a period of two months, the Board paying two-thirds and the Education Committee one-third of the cost.

Instruction is given in milking, cleaning of dairy utensils, the care and management of live stock, the general work carried on on a mixed farm, and the use of agricultural implements.

Cornwall.—The scheme which is being carried out in Cornwall provides for preliminary meetings of women at convenient centres,

at which committees are appointed, for the purpose of canvassing their parishes and ascertaining the supply of and demand for labour. These committees arrange for the canvassing by their members. Specimen canvassing forms are shown in the printed scheme. Committees have been formed in every urban and rural area, and one of their objects is to organise classes in co-operation with the County Education Authority in agricultural instruction, milking, etc. Meetings of the whole of the Parochial Committees in an education area are convened by the County Authority to report the results of the canvass, give information with regard to the loan of cows, and instructresses, and suggest to the County Authority the names of capable women for instructresses.

The subjects to be taught are :—

(1) *Dairy Work.*—Milking, cleaning dairy utensils, and, as far as the state of the County agricultural staff permits, more advanced dairy work.

(2) *Cheese-Making.*—Instruction in the making of Caerphilly, Cheddar, and other varieties of cheese.

(3) *Light Farm Work.*—Light horse implements, planting, hoeing, weeding. A women's agricultural demonstration has been conducted in one of the districts. The competitions consisted of wood-cutting and bending, hedge-paring, manure-spreading and wood-sawing. Similar demonstrations will be organised in other centres.

Cumberland and Westmorland.—If the 20 places at the Newton Rigg Farm School are not filled at each of the three summer courses for women with ordinary pupils from Cumberland and Westmorland, the vacancies are filled with women desiring training in farm work. The training includes milking, butter-making, calf and pig-feeding, poultry management, and such field work as happens to be in hand at the time, *e.g.*, turnip-hoeing, hay-making, harvesting, etc. Nine girls, who had no previous experience of farm work, received one month's training last summer. Eight of these obtained places immediately and very favourable reports have been received concerning them.

Derby.—The Governors of the Midland Agricultural and Dairy College have made arrangements to provide courses of three weeks' duration for 18 women at a time. Four women have been nominated by Derbyshire, and it is hoped that more will be forthcoming.

Devonshire. — The Governors of the Seale-Hayne Agricultural College have agreed to place at the disposal of the County, for the instruction of girls in dairy work and milking, accommodation for 15 students. Not less than eight courses of four weeks each can be arranged for, with not less than 10 students for each course, and the County will provide the instructresses and dairy apparatus.

Dorset.—Special short courses of instruction in milking and other farm work will be held in places recommended by the War Agricultural District Committees. The first class has been arranged at Charmouth and will consist of 24 lessons, from 7 a.m. to 3.30 p.m., extending over two weeks. The instructor will be paid 1*s.* per day, and no other expense is anticipated except for printing. At the end of the period the women will be free to undertake work on any farm in the district on the best terms which they can obtain. Other classes are being arranged.

Durham.—A course of training for women in light farm work was held from the 11th to 30th October, 1915, when three students were given instruction.

No further courses have yet been arranged.

Essex.—A scheme of instruction in milking has been adopted. It is proposed that in a house-to-house canvass girls and women shall be asked if they are prepared to receive instruction in milking. Canvassers will also call on the head teachers in rural schools and obtain the names of the elder boys and girls who might receive instruction. The names of farmers are to be obtained who would be willing to set aside a few cows for instruction, and provide an efficient instructor.

In order that canvassers should be in a position to give some idea of the wages which might be expected, it is suggested that during the probation period milkers might be paid 3*s*. to 4*s*. per week, and that when efficient they might be able to earn 1*s*. per cow per week for milking only.

Hampshire.—For the period of the war the fee to women students from Hampshire at the Sparsholt Farm Institute has been reduced to 10*s*. per week for board, lodging, and tuition. Further, a list is being prepared of all farmers who would be willing to allow their dairymen to give instruction in milking, and it is hoped to take advantage of this help. Milking instruction will be given by the Travelling Dairy School to a greater extent than formerly.

Herefordshire.—The Agricultural Education Sub-Committee has adopted a scheme similar to that in Worcestershire. Pupils will be sent to an approved farm in the county for two to four weeks. Daily attendance will be required, and they will work under the direction of a farmer or some other approved person with a view to getting experience in general farm work. The farmer would be paid 5*s*. per pupil per week by the Committee, and the pupil would receive 5*s*. per week from the farmer and 5*s*. from the Committee. Suitable arrangements will be made for housing the pupils in the locality.

Hertfordshire.—The County Agricultural Committee have established a scheme of training, whereby suitable women and girls may receive a practical course of instruction in milking, on a farm, with a view to qualifying themselves to take situations as milkers. A course lasts for from six to eight weeks, and the value of the exhibitions covers the cost of instruction, and provides a sum of 10*s*. per week towards each student's maintenance expenses. The cowman, or other instructor, is paid a fee of 5*s*. per week for the first pupil, and 1*s*. per week for the second and subsequent pupils. Fourteen pupils have been trained, and the scheme is being continued.

The County Agricultural Committee are prepared to arrange for the instruction of women in other branches of farm work, including the management of calves, pigs, and poultry, provided a sufficient number of candidates is forthcoming.

Kent.—The Agricultural Education Committee have made four grants of £50 each to the East Kent and West Kent Women's War Agricultural Committees for training women.

The West Kent Committee have adopted the following Scheme :—

(1) District representatives will send in the names of farmers willing to undertake voluntarily the training of women in milking and general farm work, with particulars, including the wages offered.

(2) A grant of half fees is to be given for the three weeks' poultry-management courses at Wye College (Fee, including board and lodging £4 10*s*.), the six weeks' course at Wye College in practical farm work (Fee, including board and lodging £6), and the four weeks' farm and garden course at Swanley College (Fee, including board and lodging, £6 6*s*.).

(3) Successive free courses of training for four or more students, including board and lodging, have been offered by Mr. F. Swanzy on a farm near Otford. The training consists of a nine weeks' course in dairy farming, pig and poultry-keeping, and work on arable land under a resident woman superintendent. Students must undertake to devote their time to farm work during the War.

(4) Free lectures and demonstrations on poultry, pig and goat-keeping, rough carpentering, etc., are to be given at Great Camp, Borough Green.

Lancashire.—The Education Committee have arranged free courses of training at the Hutton County Council Farm for a limited number of students, and a grant has been made by the Board for 25 students. The course lasts for one month in each case. In addition, about 12 students have been trained at Hutton at their own expense. The County Council has offered a bonus of 10*s.* per head for 60 lessons to farmers who are willing to teach women and boys and girls to milk. Each class will consist of not more than three pupils and there must be separate classes for boys and girls. A leaflet giving hints on milking has been issued for the pupils.

Short courses of instruction in dairying, poultry-keeping and horticulture are available for county and external students at nominal fees.

Leicestershire.—The Local Education Authority have made arrangements with the Midland Agricultural and Dairy College to receive women to be trained for employment in practical farming during the war. The Authority requires all such women to be attested for employment before their application for employment is considered. The course is of three weeks' duration. The County Council provide the cost of tuition but the cost of board and lodging is borne by the student. Arrangements are also being made for the training of such women on the farm where they will eventually be employed.

Forty-two women have given in their names as wishing to assist with farm work, and the County Organising Instructor is endeavouring to place them on farms for training.

The pupils will work for the first month for their board and lodging only, and afterwards they will make their own arrangements with the farmer as to wages.

Lincolnshire: Lindsey.—The Committee have offered Free Studentships enabling women to attend the Midland Agricultural and Dairy College. The men's side of the College is to be closed for the period of the War, and the resources of the College are to be used as far as practicable for women in practical work on the farm.

The Committee have also carried out two public demonstrations of farm work by women. About 30 women were employed in each of these demonstrations in ordinary farm work, such as ploughing, hedging, thrashing, etc.

Northampton.—The Education Committee propose to spend a a sum of £100 on training women for employment in agriculture during the War. The Moulton Grounds Experimental Farm will be used to give a month's training to not more than six women at a time. The pupils will be accommodated in the farm house. Cooking and attendance will be provided for them, but they will in turn cater for their own mess. They will work on the farm under the supervision of a forewoman, and will receive theoretical instruction from the Agricultural Organiser. A fee of £3 will be charged for the course, which will be returned as a weekly mess allowance of 15*s.* A wage

of 2*s.* 6*d.* in the first week, rising by 2*s.* 6*d.* per week to 10*s.* in the last week will be paid. The pupils will be selected with the assistance of the Labour Exchange and of the Labour Sub-Committee of the War Agricultural Committee. If the experiment succeeds, it is intended to include the training of other women on approved farms, in every case under the superintendence of a forewoman.

Nottingham.—The County Agricultural Education Sub-Committee in the summer of 1915 organised a scheme for the training of women in farm labour.

For 1916 the men's course of instruction at the Midland Agricultural College having been discontinued it is intended that the facilities there shall be utilised as far as possible in giving instruction to women in practical farm work. This will be given on the College Farm and on other farms in the vicinity. The College will be able to take women at the rate of six per week for three weeks' courses, but as it will serve also as a training centre for other counties as well, it is the intention to start local training centres similar to the scheme inaugurated last year at Sambley House, should the provision at the Midland Agricultural College fail to meet the demand.

In certain districts the War Agricultural Committees are proceeding with the canvass of those requiring instruction, and a few have already been sent to the Midland Agricultural College for the first course. The expenditure will be defrayed from the funds usually allowed for the agricultural instruction of male students.

The pupils are selected by the Labour Bureau which also controls their subsequent employment.

Oxford.—In June, 1915, the Agricultural Sub-Committee resolved that in the event of it being found that sufficient women desired instruction, the Organiser should be authorised to arrange for a milking instructress to visit farms where there were at least three women willing to learn to milk. This resolution was sent to the Oxfordshire Women's War Agricultural Committee who, it was hoped, would be able to get together a sufficient number of women to enable classes to be provided in some of the villages, but so far no classes have been held.

Shropshire.—(*a*) A scheme has been agreed to for the instruction of 34 women for a month in milking and light farm work at the Harper Adams College, Salop. It is hoped that these women will be spread over the county, and for this purpose the County Council propose to spend a sum of £170.

The course of instruction includes :—Milking and use of a milking machine, stock management, light farm work, and poultry-keeping.

(*b*) A scheme has been sanctioned for a course of training at a home farm, to include all the work that a woman can do at each season.

(*c*) Milking classes for women. Instruction is given at the afternoon milkings for a month or five weeks at the various farms in different parishes throughout the county. At the end of the course an examination is held. Over 100 children have been taught and nearly the whole of them are now milking regularly.

Somerset.—Fifteen dairy scholarships, tenable at either the Midland Agricultural and Dairy College, or the Lancashire Dairy School, have been awarded to train women as cheese-makers during the coming season.

Staffordshire.—A scheme of instruction in light farm work and milking has been adopted by the County Education Committee and a committee has been appointed to carry it out. Under this scheme the pupils will attend on farms approved by the Agricultural Education

Committee for at least four weeks. The farmer and committee will each pay the pupil 5*s*. per week and suitable accommodation must be found for the pupils in the locality.

The work includes :—

Milking,	Thinning and cleaning root crops,
Preparation of food for cattle,	Haymaking,
Feeding cattle, calves, pigs and poultry,	Stacking corn,
Assisting with the planting of potatoes,	Lifting potatoes, mangolds, swedes, etc.

In the case of instruction in milking, boys and girls will also be received as pupils, and will be required to attend at an approved farm each morning and evening. The farmer or other instructor will receive a grant of 5*s*. from the committee for the first pupil and 2*s* 6*d*. for each succeeding pupil, to a maximum of 10*s*. Each pupil, if found by examination to be proficient at the end of the course of instruction, will receive a grant of 15*s*.

The Committee will also pay each pupil receiving one of the grants a further bonus of £1 upon the completion of a year's regular employment in milking in the county, provided that the Committee's approval in writing has been obtained to any change of employer during this period.

Suffolk: East.—The Agricultural Organiser arranged for a demonstration of women's work, ploughing, harrowing, rolling, etc., in the early spring. It is probable that a competition of women workers for prizes will be held in connection with one of the ploughing societies in the county about Whitsuntide.

Classes in milking, cheese-making and poultry-keeping are held, at which women and children are instructed.

The Women's War Agricultural Committee have received a number of offers from farmers to run courses of instruction for women in practical farm work on their farms. Some of this instruction has already commenced.

Surrey.—In January, 1916, the County Education Committee, at the suggestion of the Surrey Committee for Women and Farm Labour, agreed to send nominees of the latter Committee for short courses at approved agricultural colleges, or to two suggested farms in the Guildford district. In the latter case, it is proposed to pay a fee of £1 to the farmer for each proficient pupil, with not more than 12*s*. 6*d*. per week maintenance grant for a course of three or four weeks' training. By the middle of April, 1916, no application had been received for the courses at Agricultural Colleges, but six women were in training at two farms in the county.

West Sussex.—The West Sussex County Council propose to arrange for 12 weeks' courses of instruction for women to be held on approved farms in the following subjects :—

Milking,	Feeding and care of calves, pigs and poultry,
Feeding and attending cows,	General farm work.
Cleaning out stalls,	
Preparation of food.	

Maintenance grants will be made as follows :—

(*a*) When the farmer provides board and lodging during the 12 weeks, paying wages of 3*s*. per week for second month and 6*s*. per week for third month, £5 will be paid to the farmer, but no grant to the pupil.

(*b*) When board and lodging for 12 weeks is provided by the pupil, and she receives wages of 8*s*. per week the second,

and 12*s*. per week the third month, £5 will be paid to the pupil, but no grant to the farmer.

Applications will be dealt with by local committees in each rural district area, formed from the District Sub-Committee of the War Agricultural Committee and the West Sussex Women's Agricultural Committee.

Wiltshire.—The Wiltshire Agricultural Committee are obtaining the names and addresses of farmers willing for women to be instructed on their farms in milking and light farm work. It is proposed to arrange for a course of ten lessons on selected farms. A scheme is being recommended for adoption with a view to as many farmers as possible in the county being provided with the women's help that they may require. It is proposed that the registrars and local committees shall be actively associated in carrying out the scheme in conjunction with the honorary secretaries of the Ladies' County War Sub-Committee and the County Agricultural Organiser.

Worcestershire.—The scheme provides for the instruction of women in light farm work, in order that they may as far as possible take the place of men away on Military duties.

The work includes :—

Preparing food,	Cleaning fallow crops,
Feeding calves, pigs and poultry,	Haymaking,
Planting potatoes, cabbages, etc.	Binding corn,
Thinning mangolds, swedes,	Digging potatoes, cleaning mangolds, etc.

The pupil must attend on an approved farm for from two to four weeks. Daily attendance is required, though not necessarily a full working day. Farmers who take pupils under the scheme receive a grant of 5*s*. per pupil per week, during the period of instruction; and pupils receive 10*s*. per week, 5*s*. being paid by the farmer, and 5*s*. by the County Agricultural Committee, on receipt of a satisfactory report from the farmer as to the pupil's work throughout the course.

An additional scheme of instruction in milking has been adopted.

Pupils must attend for instruction on an approved farm in the district twice a day for at least 28 days, at the end of which time they will be examined, and if found proficient will receive a payment of 28*s*.

The Instructor, who may be an employee on the farm where the instruction is given, will be paid 5*s*. for one pupil, and 2*s*. 6*d*. for each succeeding pupil up to a maximum of 10*s*.

A further bonus of £1 will be offered to pupils after the completion of twelve months' regular employment in milking in the county.

Yorkshire.—The Yorkshire Council for Agricultural Education conducted five short courses for women workers at their farm at Garforth last summer. Each course extended to two weeks, and 30 women were trained. The work was entirely practical, and included such operations as milking, separating milk, cleaning dairy utensils, feeding calves, pigs, poultry, etc., loading hay, cleaning turnips and mangolds, etc., and any seasonable operations on the farm. No arrangements have been made for further classes in the near future.

WALES.

Brecon.—No special instruction has yet been provided, but it is intended to arrange for women to be trained on farms on the lines set forth in the Board's Memorandum on the subject.

Glamorgan.—One course in milking, butter-making, poultry-keeping, and light farm work has been held (November 8th to 26th,

1915), and another was held from 13th March to 3rd April, both in the eastern portion of the county, and on the lines of the Nottingham scheme. All the students have obtained engagements, but not within the county.

In poultry-keeping, arrangements were made for classes for women to be conducted in the county, uninterruptedly from January to August, 1916.

The necessary arrangements were also made for conducting the following courses for women at the University College, Cardiff :—

Dairying Science	(1)	24th January to 18th May.
,, ,,	(2)	10th April to 20th May.
Milk Testing	(1)	10th to 22nd January.
,, ,,	(2)	22nd May to 23rd June.
Cheesemaking		22nd May to 12th August

These courses enable students to take the B.D.F.A. Examination in Butter-making, and the B.D.F.A. Examination in Cheese-making.

Radnor.—No special instruction has yet been provided, but it is intended to arrange for women to be trained on farms on the lines set forth in the Board's Memorandum.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

SOILS AND MANURES.

Bacterised Peat (*Jour. Roy. Agric. Soc.*, 1915).—Two different kinds of bacterised peat were sent to Woburn in 1915, one lot being moister, more fibrous, darker, more like peat litter, and containing a much larger proportion of nitrogen soluble in water.

Pot experiments were carried out in 1915 on oats, peas, and mustard, the moist peat being used at the rate of 17·8 and 35·6 tons per acre (= 1 : 9 and 1 : 19 as recommended by Prof. Bottomley). With *oats*, the nitrogen in the bacterised peat was compared with that in nitrate of soda, the latter having to be applied at the rate of 10·45 and 20·9 cwt. per acre; there was very little difference between the two manures as regards yield of grain, but the bacterised peat produced a marked increase of straw. Owing to the unsatisfactory germination of the *peas* with the bacterised peat treatment, no conclusions could be drawn as to weight of grain, but there was again a marked increase in the green portion of the plant. With *mustard*, a very clear advantage was gained by the peat treatment over the nitrate of soda.

Field experiments were carried out on oats, both kinds of bacterised peat being applied at the rate of 5 cwt. per acre; the drier kind did not do as well as when no treatment was given, while the moister kind did better. The value of bacterised peat for farm crops has yet to be etablished.

Effects of Radio-active Ores and Residues on Plant Life (*Sutton & Sons, Reading, Bull. No.* 7).—In 1915 nine different radio-active materials were used for tomatoes, potatoes, radishes, lettuces, onions, carrots, vegetable marrows, and spinach beets. The results of these careful and numerous trials gave no hope for the profitable employment of the radio-active materials.

Reclamation of Bog Land (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, January, 1916).—From the results of both pot and field experiments carried out during the last three years it is evident that lime is the "limiting factor" in the reclamation of Irish bogs; in

fact, it appears useless to attempt their reclamation without lime. Phosphate proved next in importance to lime. Nitrogen also proved necessary, notwithstanding the large amount in the peat. As long as the crops were producing leaf and stem only, potash was the least important of the four ingredients; but its influence was most marked in filling the grain and stiffening the straw in the case of rye and of increasing the yield of tubers in the case of potatoes.

FIELD CROPS.

Manuring of Brussels Sprouts (*Beds. Educ. Com., Agric. Educ. Sub. Com.*).—Nitrogen and phosphates were shown to be required for brussels sprouts on a soil on the Oxford Clay, poor in these ingredients and in lime. The plots were about $\frac{1}{14}$ acre each in extent; half the nitrate of soda was sown as soon as the plants were established, and the other half about a month later. The manuring, yields (which were affected by the dry weather), and profit were as follows (per acre):—

Manuring.	Yield.	Value of Yield.	Cost of Manures.	Profit.†
	Stones.	£ s. d.	£ s. d.	£ s. d.
7 cwt. superphosphate .. 1¼ ,, sulphate of potassium 4 ,, nitrate of soda ..	696	26 13 1	5 10 0	14 13 1
7 ,, superphosphate .. 1¼ ,, sulphate of potassium 2 ,, nitrate of soda ..	578	20 4 3	4 0 0	9 14 3
3½ ,, superphosphate .. 1¼ ,, sulphate of potassium 4 ,, nitrate of soda ..	660	23 11 3	4 12 6	12 8 9
7 ,, superphosphate .. 4 ,, nitrate of soda ..	661	23 10 2	4 15 0	12 5 2
1¼ ,, superphosphate .. 4 ,, nitrate of soda ..	410	14 12 11	3 15 0	4 7 11

* Including "tops" and "blowers."
† Cost of growth—£6 10s. per acre in each case.

Manuring of Cabbages (*Devon County Agric. Com., Report on Field Expts.*, 1912–14).—In dressings of artificials for cabbages on a heavy loam on the Devonian limestone a combination of ¾ cwt. sulphate of ammonia with 1 cwt. of nitrate of soda applied five weeks after proved the best source of nitrogen, followed by 2 cwt. nitrate of soda (in two dressings of 1 cwt.), while 3 cwt. nitrolim (in two dressings) and 1½ cwt. sulphate of ammonia were about equal in value and took third place.

Hybridisation and Water Requirement (*Jour. Agric. Research*, August, 1915).—The water requirement of eight first-generation hybrids of maize and one wheat hybrid was compared with that of their parent strains. The hybrids ranged in water requirement from 10 per cent. below to 10 per cent. above the parental mean. On the basis of the results so far obtained, the chances are even that a maize hybrid will not depart in its water requirement more than $\pm$ 6 per cent. from the parental mean. Cross pollination between individual plants of maize leads to results similar to hybridisation of different strains, so far as water requirement and yield are concerned. A wheat hybrid which had been grown for several generations gave a water requirement 14 per cent. above the mean water requirement of the parental strains.

FEEDING STUFFS AND DAIRYING.

Feeding Pigs on Grass Land (*Jour. Dept. Agric. & Tech. Instr. for Ireland*, January, 1916). In the early summer of 1914 a Waterford feeder purchased 54 store pigs averaging four to five months old. After ringing, the pigs were put into a pasture field, one lot commencing in May and a second lot in June. In addition, whole maize was fed at the rate of ¾ lb. per head per day at first, rising to 3-4 lb. as the pigs got heavier. The pigs had access to water, and an open shed provided shelter. The pigs were finished off in the last month in feeding-pens on a daily allowance of 6-8 lb. of a mixture of maize and pollard to which treacle-water was added to make the meal sufficiently moist. As the pigs approached 2 cwt. live-weight (*i.e.*, 1 cwt. 2½ qr. dead-weight) they were sent to the bacon factory, all the pigs being disposed of by the end of September.

The pigs were purchased at £79 14*s*., the food cost £123 7*s*. 8*d*., and the total cost was £209 16*s*. 10*d*.; the receipts amounted to £266 3*s*. 11*d*. Allowing a bonus of £2 5*s*. for the farm hand, a profit of nearly 25*s*. per pig during the feeding period was realised.

In a similar experiment with 51 pigs in 1915 a profit of 28*s*. 10*d*. per pig was realised, the last pigs not being sold till 26th October.

Calf Rearing (*Roy. Agric. Soc., Proceedings at Monthly Council, 29th March, 1916*).—*The first part of the new calf-rearing experiment* at Woburn has now been completed. The primary object was to see whether not only whole milk, but even separated milk could be dispensed with in the rearing of calves. The results so far obtained are summarised below :—

Food.	Gain per Calf per Week. lb.	Cost per calf per Week. s. d.	Cost per lb. Gain in Live-weight. d.
Lot 1.—Oats and separated milk	6·58	2 7	4·56
,, 2.—Calf meal and water	2·85	1 5	5·96
,, 3.—Oats and water	3·73	0 10·21	2·74
,, 4.—Palm-nut meal and water	6·00	0 10·25	1·70
,, 5.—Beans and water	4·56	0 9·75	2·14
,, 6.—Maize ,, ,,	4·54	1 1·6	2·98

The calves were two to three days old when they reached Woburn; they were all fed alike for a fortnight on new milk, and then gradually changed to the various diets which were continued for twelve weeks. Of the different foods used, palm-nut meal proved the most economical, the gain in live-weight resulting from its use along with water being but little below that obtained with crushed oats and separated milk, while the cost was considerably less. Of the other foods the order of economical return was :—Beans, then oats, and next maize—each with *water only*, while calf meal, as in the former experiments, has given the lowest return.

Calf Rearing (*West of Scotland Agric. Coll., Bull. No.* 68).—The experiments were carried out in 1914 and 1915, 16 Ayrshire calves being used in each year. For the first four weeks of their lives the calves were all fed solely on whole milk. They were then divided into four lots to test different rations, two weeks being occupied in completely effecting the change to the new ration. Hay was added to all the rations when the calves were six weeks old, and two weeks later linseed cake was introduced. The experiments were concluded

when the calves were 20 weeks old in 1914 and 16 weeks old in 1915. The rations and the results were as follows :—

Ration and Average Consumption per Calf per day.	*Lot 1.* Whole Milk, 1¼ gal.	*Lot 2.* Separated Milk, 2 gal. Crushed Oats, ¾ lb.	*Lot 3.* Separated Milk, 2 gal. Maize Meal, ½ lb.	*Lot 4.* Whey, 1¾ gal. Calf Meal, 1½ or 2 lb.
	lb.	lb.	lb.	lb.
Average weekly increase :				
1914	14·85	12·7	12·0	9·5
1915	12·6	12·1	12·1	9·7
Average cost per week :	*s. d.*	*s. d.*	*s. d.*	*s. d.*
1914	7 11	3 8½	3 7½	3 0
1915	7 10½	3 8½	3 7½	3 4½
Cost per lb. live-weight increase :	*d.*	*d.*	*d.*	*d.*
1914	6·4	3·5	3·62	4·0
1915	7·5	3·67	3·60	4·2

The maize meal was scalded and fed along with the separated milk in the form of porridge ; the calves took much more readily to this ration than to the separated milk and crushed oats ration, the crushed oats being fed dry and just after the calves had been given their milk.

Lot 4 were fed with 2 lb. per head per day of a meal consisting of equal parts by weight of linseed meal, oat meal, fine thirds, and pea meal ; in 1915 pea meal was omitted ; the meal was made into a kind of porridge and fed along with the whey. The calves did not take to the whey at first, and the ration had a tendency to scour them ; in 1915 whole milk formed the sole ration for five weeks instead of 4 with Lot 4, and the transition period was spread over three weeks ; and 1½ lb. of the meal was fed per day.

The conclusion drawn from these experiments is that calves can be fed on whole milk for the first four weeks of their lives, and afterwards reared until twenty weeks old on separated milk with crushed oats or maize meal, together with hay and linseed cake, at a cost in normal times of little more than £3 per animal ; the whey ration is not recommended.

Straw "Concentrate" in Germany.—It was shown by Kellner that straw-cellulose, obtained from the chemical treatment of straw (such as is used in paper factories), had a food value equal to starch for cattle ; and Fingerling later showed that pigs could also make good use of this food. Up to the present, however, the substance could not be obtained in a suitable form for feeding, but it is now claimed by the Prussian Ministry of Agriculture that Dr. Oexmann has got over this difficulty, and that a number of factories will soon be turning out this new "straw concentrate."

It is stated that experiments carried out for some months with this food have shown its value, in spite of its poverty in protein. Zuntz concludes that for horses 10 lb. oats can be replaced by 8 lb. straw concentrate + ·24 lb. albuminoids. Another experimenter, who has carried out trials for four months with 20 heavy work horses, concludes

that for such horses 8-10 lb. grain can be replaced by 8-10 lb. straw concentrate without harmful effect, if a certain quantity of oats (2-4 lb.) is added, and some protein given. Other experiments to the same effect with horses are quoted. Equally good results have been obtained with pigs, the best plan being to replace not more than 2 lb. of the usual concentrates with the straw concentrate.

It is now proposed to add to this new food 6 per cent. of albuminoids in the form of dried yeast, the resulting composition resembling that of crushed maize. German farmers are urged to send their straw to the new manufactories. (*Deutscher Reichsanzeiger*, 22nd February, 1916.)

A note in the *Wiener Landw. Ztg.* of 6th May, 1916, states that in the Oexmann process straw is soaked in a solution of carbonate of soda, the resulting straw material being mixed with potato flakes and 15 to 20 per cent. of molasses and then dried.

Experiments by Schneidewind with finely-ground straw meal and also with the Oexmann concentrate (65 per cent. straw, 25 per cent. dried potato and 15 per cent. molasses) on pigs were reported in the *Deutsche Landw. Presse* of 9th February, 1916. Pigs fed for 61 days on a ration to which 4½-6½ lb. per day of straw meal was added gained 60 lb. *less* per head over the period than where the straw meal was omitted; *i.e.*, the straw meal was actually harmful. Better live-weight increases were made by pigs fed on the Oexmann concentrate, but Schneidewind attributes only a small part to the straw present and most to the potatoes and molasses.

The Prussian Ministry of Agriculture, in the notice above mentioned, ascribe this inferior result to the material being of a different composition and prepared by a superseded process as compared with the material now on the market.

Feeding Experiments with Work Horses.—In a recently published report of Swedish experiments (*Fortsatta Utfodrings försök med Arbetshästar*, utförda aren 1909–1915) by Nils Hansson, it is shown that a large number of foods can be fed with some degree of freedom to work horses; barley, mixed barley and oats, and maize in suitable quantities successfully replaced oats, and other foods included in rations on which the horses throve were wheat bran, oat bran, a mixture of oat bran and rice meal, molasses, sugar slices, potato flakes and cooked potatoes.

The experiments to which particular attention is drawn were carried out in six series: (i.) barley *v.* oats; (ii.) oats *v.* wheat bran; (iii.) maize *v.* oats; (iv.) mixed barley and oats *v.* wheat bran; (v.) mixed barley and oats *v.* a mixture of 60 per cent. oat bran and 40 per cent. rice meal ("Gøta" feed); (vi.) barley *v.* cooked potatoes. The tests were carried out at various centres between 1909 and 1915. The basal rations (generally hay, straw and concentrates) were the same in any particular trial, the two foods under test being added in proportions suggested by their respective feeding values as revealed by analysis; that these proportions were accurately judged is shown by the fact that the average live-weight increases or decreases of the lots of animals compared in each experiment did not differ materially.

Barley v. *Oats.*—These experiments showed that 4·09 kg. of barley were equal in feeding value to 4·91 kg. of oats; *i.e.*, provided that not more than one-half to two-thirds of the oats are replaced by barley, 1 lb. of barley can be substituted for every 1·2 lb. of the oats; similarly, 1 lb. of barley could be substituted for 1·1 lb. of mixed oats and barley. The average amount of barley fed per horse per day exceeded 12 lb. at

Alnarp in 1912. (Barley also replaced equal quantities of oats in two experiments with milk cows and the milk yields were the same as with oats; in an experiment with pigs in which 1 lb. of barley was tested against 1·2 lb. of oats the barley-fed pigs gained 1·285 lb. per head per day and the oats-fed 1·294 lb. per head per day).

Oats v. *Wheat Bran*.—It is concluded from these experiments that, provided the wheat bran does not exceed one-third of the concentrated ration (on account of its laxative properties) it can replace oats in practically equal quantities (other experiments showed wheat bran to have practically the same value as oats for milk cows).

Maize v. *Oats*.—Only two experiments were carried out, at Svalöf, in the same year, and with only three animals each. The conclusion, however, is drawn that, provided the maize is finely ground and is not used in quantities above one-half of the concentrated ration, it has a feeding value about 20 per cent. higher than oats, *i.e.*, 1·2 lb. of oats can be replaced by 1 lb. of maize. Being a starchy food, maize requires to be used along with protein-rich foods for work horses.

Mixed Barley and Oats v. *Oat Bran*.—The oat bran contained over 20 per cent. of fibre; it proved of inferior value as a concentrate, 2·92 lb. being equal to 1·85 lb. of mixed barley and oats, *i.e.*, 1 lb. of oats would need to be replaced by 1½ lb. of oat bran (if the fibre content of the latter did not exceed 20·5 per cent.). It is stated that the amount of oat bran fed should not exceed 8·8 lb. per head per day, and should be in fine condition. (Oat bran was also shown to be suitable for dairy cows, but not so suitable for swine on account of its high fibre content).

Mixed Barley and Oats v. *Mixed Oat Bran and Rice Meal*.—The addition of rice meal (40 per cent.) to the oat bran (60 per cent.) (Göta feed) gave a mixture of higher feeding value which could be fed to work horses in larger quantities than oat bran alone; 1 lb. of oats was replaceable by 1¼ lb. of the oat-bran-rice-meal mixture.

Barley v. *Cooked Potatoes*.—On the average of these two experiments 2·97 lb. of barley proved equal to 10·61 lb. of potatoes: *i.e.*, 1 lb. of barley was equivalent to 3·57 lb. of cooked potatoes, or 0·9 lb. of dry matter in the potatoes (the latter contained 24·5 per cent. of dry matter). The potatoes were fed to the extent of 23·4 lb. per head per day.

Summarising the above results in the light of experience gained at the Swedish Central Institute it is concluded that 1 lb. of barley may be replaced by the following quantities of other foods for work horses:—1·1 lb. mixed barley and oats, 1·2 lb. oats, 0·95 to 1·0 lb. maize, 1·0 lb. molasses, 1·1 lb. sugar beet slices, 1·2 lb. wheat bran, 1·5 lb. mixed oat bran and rice meal (3 : 2), 1·8 lb. oat bran, 0·9 lb. dry matter in potatoes, and 1·1 lb. dry matter in roots. These quantities relate to foods of average quality.

Apart from the need of adding feeding phosphate in the case of rations containing some of the above foods, the most important consideration is the minimum protein content; where considerable quantities of potatoes, roots, molasses, maize, etc., are fed, additional protein must be given in the form of ground-nut cake, soya-bean cake, linseed cake, peas, beans, gluten feed, or good hay with clover, lucerne or other leguminous fodder.

The following are given as the requirements of work horses of 1,300 lb. live-weight, as regards digestible protein (lb. per head per day):—

Work Horses of 1,300 lb. Live-weight.	*lb. dig. Protein per Head per day.*
Easy work	1.1 to 1.32.
Moderate work	1.32 ,, 1.76.
Hard work	1.76 ,, 2.20.
Very hard work	2.20 +

VETERINARY SCIENCE.

Different Methods of Testing with Tuberculin (*Jour. Roy. Agric. Soc.*, 1915).—Experiments with two new methods of testing with tuberculin—(1) the conjunctival, or eye test, and (2) the intracutaneous test—have recently been carried out at the Royal Veterinary College. Young, healthy cattle were inoculated with tubercle bacilli and tested at intervals by these methods and the subcutaneous method. In the case of the conjunctival test, tuberculin is introduced into an eye of the animal. The occurrence of congestion or a manifest overflow of tears, and the formation of a more or less opaque muco-purulent material in the eye indicates that the animal is tuberculous. In the intracutaneous test the tuberculin is injected into either of the two thin double folds of skin which are seen extending from the root of the tail on either side of the animal's anus when the tail is elevated. A reaction here is constituted by a pronounced swelling and thickening of the fold, which increases until the second day or later. The failures in these two tests were more numerous than in the subcutaneous test. The new tests sometimes, however, provoke very distinct symptoms of tuberculosis in animals which have not reacted to the subcutaneous test, and may be used with that test as an additional safeguard.

Hydrocyanic Acid in Sorghum (*Jour. Agric. Research*, U.S.A., May, 1915).—When sorghum is grown on poor, infertile soil, added nitrogen may slightly increase the amount of hydrocyanic acid in the plant. With a fertile soil and abundant nitrogen this effect may not be produced.

During the first three or four weeks of the plant's life the prussic acid is concentrated in the stalks. Then it rapidly decreases and disappears there, but apparently persists in the leaves in decreasing percentages until maturity.

Climate and variety may be more important factors than soil nitrogen in determining the amount of acid in the plant.

Complete hydrolysis of the glucoside is obtained by digesting the macerated tissue for two hours at 40° to 45° C.

Sorghum Poisoning (*Oklahoma Agric. Expt. Sta., Circ. No.* 38).—The results of the Nebraska Station investigation are quoted, in which the mortality among cattle was 8·1 per cent. when the animals were fed exclusively on sorghum, and 6·1 per cent. when some other food was fed in addition.

In Oklahoma a case came under notice in which a number of cows had fed for a few minutes on plants 10 in. high. Three of the animals died after being in the field about 30 minutes, and within 2 hours 4 others died. A few were slightly bloated and were not relieved when the rumen was punctured. One animal was saved without treatment. The symptoms of this animal were as follows: Lying on the ground with head turned into right side, frothing at the mouth, difficult breathing and dilated pupils; gradually the breathing became better and the head changed to a normal position. A post mortem showed nothing unusual except that the first stomach, the rumen, of each animal was full, and the contents were collected into a compact mass.

Laboratory examination of different varieties showed a content of hydrocyanic acid, calculated as potassium cyanide, of ·024 and ·03 per cent. in two dried samples, and a content varying from ·0018 to ·0042 per cent. in 6 fresh samples.

It is stated that hydrocyanic acid has been found at various stages of growth of the plant, stunted plants in need of rain being especially dangerous.

Among the antidotes recommended are dosing with a quick-acting purgative; inhalation and subcutaneous injection of ammonia; and peroxide of hydrogen.

Equisetum Poisoning (*Trudy Bjuro po prikladnoj Botanikje*, January, 1916).—Complaints of *Equisetum* poisoning have been fairly frequent in the Russian agricultural press. In this publication the symptoms of poisoning are briefly described from observations made, and measures for eradicating the pest are given.

In horses the symptoms appear suddenly; there is unsteady gait, trembling, falling, convulsions and death from spinal-cephalic paralysis.

In cattle the first symptoms are diarrhœa and bloody urination; in pregnant animals casting of young; weakness accompanied by loss of condition; diminution of milk; and teeth and hair fall out. The plant is more injurious dried (in hay) than green.

To eradicate the weed deep ploughing is recommended on arable land, and, in meadows, draining and renovation with suitable cultivation.

WEEDS AND PLANT PESTS.

Eradication of Bracken (*Univ. Coll. of N. Wales, Dept. of Agric., Bulls. V.*, 1914, *and III.*, 1915).—Two series of experiments against bracken have been carried out. In the first, carried out at six centres, the area of bracken-infested land was divided into three plots in 1913. Plot I. was cut repeatedly, but received no manure; Plot II. was also cut repeatedly, but was divided into sub-plots receiving various manurial dressings; Plot III. was similarly manured, but was left uncut. In 1914 and 1915 the cutting was continued, but no further manurial treatment was given. It appears that cutting the bracken three or four times the first year, and two or three times the second, with an occasional cutting in subsequent summers, will suffice to keep it in check. The bracken on Plot I. weakened markedly, but the weakened plants assumed a dwarf-like character, making it difficult to complete the eradication of the pest. The manures applied have had practically no effect on the bracken beyond strengthening its growth.

In the second series the object in view at nine centres in 1914 was to test whether cutting the bracken once at a certain period of its growth was not as effective as several cuttings throughout the season. The results obtained in 1914 and 1915 suggested that one cutting, made when the bracken has just reached full growth, exhausts the underground store of food more thoroughly than repeated cuttings made while the bracken is very young. The best time for cutting in North Wales appeared to be about the beginning of July.

Potato Spraying (*Herts. C. C. Agric. Sub-Com. Leaflet* 15.)—The effect of spraying with Bordeaux mixture was tested with each of six varieties of potatoes. Planting took place on 20th April and spraying on 19th July. At the time of spraying a little disease was beginning to show, and this quickly spread over the unsprayed parts of the plots, while the foliage kept growing on the sprayed plots for perhaps a fort-

night longer. The crop of King Edward VII. proved smaller on the sprayed than on the unsprayed part of the plot. The average increase in crop due to spraying of the other six varieties was 1 ton 2 cwt. per acre.

Black Heart of Potatoes (*Centralblatt für Bakteriologie, &c.*, Bd. 43, No. 19/24, 4th June, 1915).—The conclusions reached in this paper are that (1) black heart of potatoes results from abnormal physiological changes and not from a parasitic organism; (2) that it may be produced artificially by subjecting the potatoes to a temperature of from 38–48° C. for from 15 to 20 hours, and that since each of sixteen varieties tested responded to this treatment all varieties may be assumed to behave similarly; (3) that by supplying sufficient oxygen during the period of heating the abnormality may be prevented, but the demand for oxygen during this period is greater than can be supplied by subjecting the potatoes to a constant stream of air; (4) that if, after heating, the potatoes are kept in an atmosphere devoid of oxygen the tissues will not blacken; (5) that usually the abnormality cannot be detected before cutting open the tuber. If the affected tubers are allowed to remain a week or ten days before cutting open, a hollow is formed in the interior due to the shrinking of the tissues, which undergo a series of colour-changes varying from light pink to coal black.

The formation of black heart in potatoes is of great economic importance. It may be prevented by proper ventilation and by keeping the potatoes in a temperature which does not exceed 35° C.

NOTES ON AGRICULTURAL CO-OPERATION.

Co-operative Horse Insurance Societies.

So far as the Board have been able to ascertain, there are no co-operative societies for the insurance of horses in Wales, and only 15 in England, of which 6 are in Cambridgeshire. Five of them are registered under the Friendly Societies Act. Statistics have been obtained for 12 of the societies and show that, taken together, these societies had 755 members and insured 1,311 horses—an average per society of 63 members and 109 horses—less than 2 horses per member. Five of them insured cattle also, to the number of 680. The 12 societies had reserve funds aggregating £2,785. The oldest society, that at Soham in Cambridgeshire, founded in 1866, is also the largest, and, on the whole, the most successful. In 1913 it consisted of 180 members, insured 230 horses and 380 cattle, and had a reserve fund of £534. The number of these societies is so small, and the systems on which they work differ so much in detail, that it would be misleading to attempt to give general averages of their statistics, and a better idea of the working of co-operative horse insurance will be obtained by studying several of the societies separately.

Information on the Newark Horse Keepers' Insurance Company was given in this *Journal* in October, 1914, p. 644; on the Bedworth Co-operative Horse Insurance Society in April, 1913; on the Coveney Cattle Club, which insures horses, in March, 1915; and on the Soham Cattle Club, which insures horses, in December, 1914. Other societies are dealt with below.

Isleham Cattle Club.—In the year 1884 a number of smallholders at Isleham, a rural parish near the eastern border of Cambridgeshire, founded a Horse Insurance Club, which in 1914 consisted of 41 members, almost all of them smallholders or market gardeners, and insured 83 horses, an average per member of 2; though one member insures as many as 7. The horses are mainly used for farm work, or for carrying vegetables to the market in light carts. They comprise 45 mares, 9 horses, 11 ponies and 18 yearlings, colts and foals. The insured horses are valued twice a year, in April and October, by two valuers, a farmer and a smallholder. A new member pays 1*s*. 3*d*. entrance fee, and the premium is 2*d*. per £1 per quarter on the insured value of each animal. No animal can be accepted until it has been in the possession of its owner for 14 days, and has been passed by the valuers, and no new member can receive any benefit from the club until he has paid three quarters' subscriptions. Should an insured animal die, the society pays the owner three-fourths of the value placed upon it at the last valuation, so that the insurance contribution of 2*d*. per £1 per quarter, or 3⅓ per cent. per annum on the insured value, equals nearly 4½ per cent. on the amount payable as compensation in case of death. There is no extra charge made for foaling risks. No limit is fixed as to the age of an animal on admission for insurance, but no horse is admitted unless it is worth £8. The highest value at present placed on any insured horse is £34, and the average value of the 83 horses is £19 14*s*. So far as can be made out from the accounts, the average death-rate of the past five years has been 3·3 per cent. per annum. The funds of the society are kept in the Post Office Savings Bank, and during the five years there has been an average annual profit of £17. The reserve fund now amounts to £278, which is equivalent to more than 10 years average payments on claims, so that the Society is in a very sound financial position.

Haddenham Cattle Insurance Club.—This club was founded in 1888 at Haddenham, a rural parish in Cambridgeshire. It insures both horses and cattle. Its operations embrace 6 parishes, and it is managed by a committee of 23 members. There are now altogether 122 members, mostly smallholders, some of whom have risen from the position of labourers. A new member is not entitled to receive any benefit from the society until he has been enrolled for 3 months. The entrance fee for a horse is 2*s*. and for a cow 1*s*. 6*d*. The animals insured are not valued, except when they fall ill or die, when the valuers, consisting generally of the members of committee for the village concerned, inspect the animal and fix its value, which is paid in full to the owner if the animal dies, but subject to a maximum of £10 for a cow and £15 for a horse. Each member pays a monthly subscription of 4*d*. for a cow and 6*d*. for a horse. The rules give the committee power to make a levy of 1*s*. per head of stock whenever necessary, and on several occasions in the club's history an extra levy has been made. In 1913 the society insured 240 horses and 187 cattle, the largest number of animals insured by any one member being 10 horses and 4 cattle. During the previous 10 years the average death-rate per cent. per annum was 4·5 for horses and 2·5 for cattle. The average amount paid per animal that died was £8 8*s*. for a horse and £8 10*s*. for a cow, equivalent to an average annual charge of 7*s*. 6*d*. per horse and 4*s*. 3*d*. per cow. As the amount received in monthly contributions was only 6*s*. per horse and 4*s*. per cow per annum, the income from this source

was not sufficient to cover the expenditure in payment of claims. The only other expenditure the society has had to meet has been costs of management, which have been small, as the officers of the society all render their services gratuitously, and for the 10 years the costs of management averaged only 3½*d.* per annum per animal insured. The total expenditure averaged £126 3*s.*, and as the total income, including monthly subscriptions, entrance fees and receipts from the sale of carcasses, averaged only £122 2*s.*, there was an average loss per annum of £4 1*s.*, and during the 10 years the net assets of the society fell from about £102 to £61 9*s.* 6*d.*

Average death-rate among horses.—If the experience of these 6 societies as regards horses is considered together, the following results are obtained, as regards the death-rate to be expected, that is, the percentage of animals insured on which claims are likely to have to be paid in an average year.

Society.	Class of Horse.	Number of years' statistics.	Average number of horses insured.	Average number of claims paid per annum.	Actual average death-rate per annum.
Newark ..	Non-agricultural	12	170	3·9	2·3
Bedworth	,, ,,	6	124	8·0	6·5
Isleham ..	Agricultural ..	5	61	2·0	3·3
Haddenham	,, ..	10	223	10·0	4·5
Coveney ..	,, ..	11	55	2·0	3·6
Soham ..	,, ..	11	206	8·3	4·0
Total all six societies			839	34·2	4·1
Total four agricultural societies ..			545	22·3	4·1

So far as these statistics go, they seem to show that an average co-operative society, consisting mainly of farmers and smallholders and insuring chiefly horses engaged in ordinary farm work or light road-work, has reason to expect that, if managed on sound lines, its average annual casualty rate will be about 4 per cent. per annum. This is a good deal higher than the 2·6 per cent., which is the actual average casualty rate among cows, according to 3 years' experience of 88 cow insurance societies insuring 9,882 cows and calves per annum (*see* this *Journal* for January, 1915). But it is to be remembered that in the ordinary course a cow, if it continues healthy, is fattened and sold for human food, in which case no claim is payable by the society; whereas a horse is only slaughtered when it can work no longer, and therefore every insured horse, unless sold by its owner, will sooner or later have to be paid for by the society. On the other hand, it seems that farmers and smallholders generally manage to sell their horses before they are past work, a practice which reduces the number of animals that have ultimately to be paid for on claims. The hauliers of Bedworth sometimes buy these half worn-out animals; and considering the age and class of horse insured in their society, and the heavy work many of them have to do in hauling loads of coal, their average casualty rate of 6·5 per cent. per annum is really low. The very low death-rate of 2·3 per cent. per annum at Newark is due to the fact that a number of the insured horses are valuable animals, carefully looked after by their owners, and that the company's

veterinary surgeon rejects all but thoroughly healthy horses, and does his best to cure those that fall ill.

Average Amount Paid on Claims.—As regards the amount payable in claims the following results are obtained for the four Agricultural societies—

Society.	Maximum valuation.	Proportion of insurance value paid on claims.	Number of years' statistics.	Total number of horses insured multiplied by years of insurance.	Total number of claims paid on horses.	Total amount paid on claims.	Average amount paid. Per horse that died.	Average amount paid. Per horse insured.
	£					£	£ s. d.	s. d.
Isleham ..	34	Three-fourths.	5	305	10	123	12 6 0	8 1
Haddenham	15	The whole.	10	2,230	100	838	8 8 0	7 6
Coveney ..	35	Seven-eighths.	11	608	22	244	11 2 0	8 1
Soham ..	35	Seven-eighths.	11	2,265	91	1,290	14 4 0	11 5
Total	—	—	—	5,408	223	2,495	11 4 0	9 3
Total for three societies (omitting Haddenham)				3,178	123	1,657	13 10 0	10 5

From the experience of these societies it is obvious that, as might have been expected, the rate of mortality is higher among the less valuable animals, including the foals and old horses, which are more liable to sickness and death, than among the more valuable animals, most of which are in the prime of life. The figures seem to show that an agricultural society, which limits the value for insurance to £35 in the case of any horse, and pays on claims seven-eighths of the insurance value, is not likely to have to pay on the average as much as £15 per claim. If it had to pay as much as this on 4 per cent. of the horses insured every year, its average annual payment on claims would be 12*s.* per annum per horse insured. The actual payments on claims have, for the three societies, omitting Haddenham, which does not pay more than £15 on any horse, averaged 10*s.* 5*d.* per annum per horse insured.

System of Valuation.—An ordinary store-pig generally increases rapidly in value as it gets older and fatter, and it would not be fair to pay compensation on its death without regard to its value at the time. Accordingly, almost all pig insurance societies have a system under which an insured pig is valued by a committee of the society at the time it falls ill or dies or meets with an accident, and the value then placed upon it by the committee determines the amount to be paid as compensation to the owner in case of its death. A cow's value also changes a good deal during the year, according as it is in calf or in milk or not, so that most cow insurance societies have also adopted the same plan. An ordinary working-horse, however, does not change in value very rapidly, and most horse insurance societies find it best to have all the insured horses valued once or twice a year and to accept the value placed on any horse at one of those periodical valuations as determining the amount of compensation payable to its owner in case it dies before the next valuation. The Newark Company has its valuation made once a year, in December, by its veterinary surgeon and directors, who go in pairs or threes and inspect the horses on their owners' premises without notice. The Bedworth Society makes its

members bring all the insured horses to one place once a year, in May, and accepts the valuation put upon them by the veterinary surgeon. At Isleham the horses are assembled twice a year, in April and October, and are valued by two men nominated by the society. At Haddenham, which pays only £15 as a maximum, a horse is valued only when it falls ill. At Coveney, each member is allowed, on entering a horse for insurance, to fix the amount he will claim if it dies; but if it does fall ill or die the committee estimates its value when it was last in good health, and the amount of compensation payable is determined by the owner's valuation or the committee's valuation, whichever is less. At Soham the horses are all valued twice a year, in April and October, by the two stewards and the secretary, who go round and inspect the animals on their owners' premises.

In order to save the funds of the society from being exhausted by a few heavy claims it is usual to fix a maximum (say £35) above which a horse must not be valued for insurance purposes, however valuable it may be. In some societies also, the owner is allowed to put his own value for insurance purposes on the horse, so long as this value does not exceed its market value as estimated by the committee. This practice has the advantage of avoiding disputes between the owner and the committee's valuers as to the actual value of the horse, and encourages men to insure who would not care to pay the insurance contribution (fixed as a percentage of the insurance value) on the full value of the animal, and who are content to accept less than the full value as compensation in case of its death.

Method of Charging Insurance Contribution.—In the case of pigs and cows whose value changes somewhat rapidly, it is generally found most convenient to charge a flat rate of insurance contribution, which does not vary with the value of the animal; but in the case of horses, when a society has fixed a value for each horse separately, it is easy to make the contribution vary with the value of the animal by charging a proportionate rate, a much fairer plan.

The Newark Company has a scale of rates which makes the premium payment about $5\frac{5}{6}$ per cent. per annum on the insurance value of each horse, but this rate includes a profit for the shareholders.

At Bedworth the insurance contribution is payable fortnightly, and is charged at the rate of 1*d.* per week for every £5, or part of £5, at which a horse is valued, equivalent to about $4\frac{1}{3}$ per cent. per annum on the insurance value, or about 6 per cent. on the amount payable as compensation in case of death, which is three-fourths of the value for insurance. The death-rate at Bedworth is exceptionally high, but at this rate the net assets of the society have increased in 6 years from £181 to £300.

At Isleham a member pays 2*d.* per £1 per quarter on the insurance value of each animal, equal to $3\frac{1}{3}$ per cent. per annum on the insurance value, or nearly $4\frac{1}{2}$ per cent. on the three-fourths of the insurance value actually payable as compensation; the society's net assets have increased in the 5 years from £188 to £272.

At Haddenham the society pays the full value of a horse that dies, subject to a maximum of £15, and charges a flat rate of 6*d.* a month, say 6*s.* a year, for each horse; but its net assets have fallen off, and its experience shows that this rate does not cover the losses.

At Coveney the insurance contribution is $1\frac{1}{2}$*d.* in the £1 per quarter on working horses and $2\frac{1}{2}$*d.* on brood-mares, equal to $2\frac{1}{2}$ per cent. and

4⅛ per cent., respectively, per annum on the insurance value, and to about 3 and 5 per cent., respectively, per annum, on the seven-eighths of the insurance value payable as compensation. Under this system the net assets of the society have increased in 11 years from £136 to £365.

At Soham the rate is made to vary with the state of the finances, the object being to keep the reserve fund at about £600. During 10 years in which the rate was 1½*d.* in the £1 per quarter, equivalent to 2½ per cent. per annum on the insurance value, and to about 3 per cent. per annum on the amount of compensation payable in case of death, the net assets rose from £420 to £775. The rate was then reduced to 1*d.* per £1 per quarter, equivalent to 1⅔ per cent. per annum on the insurance value and to about 2 per cent. per annum on the seven-eighths payable in case of death; but as at this rate the reserve fund fell below £600, the rate of contribution has recently again been raised to 1½*d.* per £1 per quarter.

From the combined experience of these societies, the best system would appear to be to have all the insured horses valued twice a year by a valuation committee nominated by the society, with power to accept the owner's own valuation, provided it does not exceed what the committee consider to be the true market-value of the animal at the time. The value for insurance purposes or "insurance value" should in no case exceed £35, and should always be fixed in even pounds, as is done at Soham. This makes the accounts much simpler, and each owner can then easily calculate the amount of his quarterly contribution for himself. The compensation payable by the society to the owner on any horse that dies should be seven-eighths of the insurance value as fixed at the last half-yearly valuation. The insurance contribution should be payable quarterly at the rate of 2½*d.* per £1 per quarter for brood-mares, and of 1½*d.* per £1 per quarter for all other animals, calculated on the insurance value of each animal as fixed at the last valuation.

The experience of the agricultural societies described above shows that, under such a system, an ordinary rural society may expect that its average income will exceed its average expenditure, and that it will soon accumulate a good reserve fund, which will secure it against the risk of having to make special levies in bad years, and will bring in a substantial income in interest.

When the reserve fund has reached a satisfactory figure the society will be in a position to increase the privileges it offers its members, for instance, by raising the maximum allowed as "insurance value," or reducing the age at which young animals are accepted for insurance, or by lowering the rate of insurance contribution charged to old members, as has been done by the Coveney Society.

As shown above, the proposed rate of 1½ per £1 per quarter is equivalent to only about 3 per cent. per annum on the amount of compensation actually payable, whereas the actual average death-rate is about 4 per cent. per annum. The reasons why a rate of contribution lower than the actual death-rate is, as a matter of experience, found sufficient, are that, besides these insurance contributions the insurance fund receives an income from entrance fees, interest and sale of carcasses; and that, as already pointed out, the death-rate among the more valuable animals, which pay larger insurance contributions, is lower than among the less valuable animals, on which smaller amounts of compensation have to be paid by the society.

Management Expenses.—At Isleham the secretary is paid 15*s*. a year, the treasurer 10*s*., and the valuers £2; nothing is paid for rent, and the management expenses come to about 10*d*. per annum per animal insured. At Haddenham the officers all work for nothing, and the clerical expenses come to only about 3½*d*. per annum per animal. At Coveney the secretary receives £1 10*s*. per annum, and the expenses of management altogether average £2 8*s*. 6*d*., or about 6*d*. per animal. The much larger society at Soham pays its secretary and treasurer £3 a year and its stewards about £6, including travelling expenses, and the total costs of management average less than 6*d*. per annum per animal insured.

It would seem advisable for a new society to keep a separate account for management expenses, and to charge at first a management contribution of 3*d*. per quarter (1*s*. a year) per animal insured. This should enable it to pay a fair remuneration to its secretary. If, at any time, the balance at the credit of the management fund was unnecessarily large, the rate of management contribution could be temporarily reduced.

Society's Veterinary Surgeon.—Both horse and cow insurance societies might well follow the example of the Newark Company and the Bedworth Society, and employ a veterinary surgeon who, for a contract payment, would be bound to help in passing and valuing the animals offered for insurance, and to supply veterinary attendance and medicine free of charge for all insured animals, whenever his services were required. Under such a system the members would get veterinary services at a lower rate than they would have to pay if they employed the surgeon individually, but, of course, it would be necessary to increase the charge for management expenses by such a sum as would be sufficient to meet the contract price agreed upon between the veterinary surgeon and the society.

Comparison with Insurance Companies.—Under the system above described a small-holder owning one horse will pay altogether to his society, including management contribution and entrance fee, less than 3½ per cent. per annum on the amount he will actually receive from the society if his horse should die from disease or accident. For instance, on a horse worth £20 he will pay per quarter 2*s*. 6*d*. as insurance contribution and 3*d*. as management contribution, or altogether 11*s*. a year, and he will receive £17 10*s*. if it dies. He will be able to insure his young stock at a similar proportionate rate and to keep his old horse under insurance at a gradually decreasing cost, so long as he does not sell it, until it dies on his hands. He will also have reason to expect that his society will gradually build up a reserve fund which will ultimately enable it to reduce the rate charged to him, possibly to 2 per cent. per annum or less, as is the case now in the Coveney Society, where a member of five years' standing now pays only 6*s*. 8*d*. a year altogether for the insurance of a £20 horse.

If he insured his horse with an ordinary live stock insurance company he would have to pay an annual premium of 5 per cent. on the amount payable in case of death. (When a number of horses are insured by the same owner the usual rate is 4 per cent.) That is to say, if he insured to get £17 10*s*. he would pay 17*s*. 6*d*. a year as compared with the 11*s*. a year he would pay under the above scheme to his co-operative society. This would be the rate payable only while his horse was in the prime of life; when it got to be over 10 or 12 years old the insurance company would charge a considerably higher

rate of premium. He would also find it difficult to get the company to insure any of his young stock till they were 2 years old; nor could he look forward to a future reduction in his rate of premium as he could if his society is successful in accumulating a reserve fund.

Co-operative insurance is, according to the experience of the co-operative horse and cow insurance societies in this country, much cheaper than joint-stock insurance, for the following reasons. An ordinary livestock insurance company has to expend large sums in the provision of offices, staff, commission, travelling expenses, veterinary fees, and dividends to shareholders. To meet this expenditure it has to charge as premium at least 50 per cent. above the actual amount required to meet the losses payable on claims. On the other hand, a co-operative insurance society has no commission or dividends to pay, and has to meet only a very small expenditure on rent and staff, as its operations cover only a small area; and the members of committee, secretary, stewards, etc., are willing to carry out all the necessary duties of management either without remuneration or for very small salaries. Much, therefore, of the work which has to be paid for by an insurance company is done for nothing by members of the society in order to help their fellow-members.

Again, a distant impersonal insurance company has difficulty in securing itself against fraud or carelessness on the part of the insurers. In the case of a co-operative insurance society, however, as the members all live within a short distance of each other, and are interested personally in seeing that the rules of the society are properly carried out, they exercise the strong pressure of local public opinion on any member who may be inclined to neglect his animals, or to act unfairly by the society, so that the casualty rate in the case of a co-operative society is generally much lower than in the case of a large livestock insurance company. This makes it possible for the society to charge a considerably lower premium than a company has to charge in order to pay the claims made upon it. Another advantage is that a small co-operative insurance society has much less difficulty than a distant company in arranging for a fair valuation of the insured animals, so that no insurer who makes a claim shall receive more than is justly due to him.

OFFICIAL NOTICES AND CIRCULARS.

Maintenance of Home-Grown Food Supplies.

THE attention of the Board's representatives before the Appeal and Local Tribunals in England and Wales was directed on the 12th May to the following answer, which was given by the Prime Minister in reply to a question in the House of Commons on the 11th May. The Prime Minister said:—

"I can only repeat with emphasis that the Government hold "that the Maintenance of the Highest Possible Output of Home-"Grown Food Supplies remains a national object of a most "essential nature, and that labour which is essential and "irreplaceable should be retained on the land for this purpose. "The Military representatives and members of Tribunals should "be in possession of Regulations and Instructions which should "ensure the carrying out of this policy."

The Board's representatives have been instructed that they should not hesitate to bring this important announcement to the special notice of the Tribunals.

AN APPEAL TO ALL WOMEN

ALL Women want to help their Country.
The Country needs the help of every woman.

HOW ARE YOU HELPING TO WIN THE WAR?
WHAT MORE CAN YOU DO?
READ THIS AND THINK IT OVER.

The Country MUST Keep Up and Increase its Food Supply.

It is the Farmers to whom we look to do this. But at the same time Farm Labourers have been called away in their thousands to serve their King and Country elsewhere. What are the Farmers to do? How can they answer their Country's call, if they have not enough men to work their Farms? They can only do it with your help. Your Country needs *your* help. Give it willingly and prove that the Women of this Country can help with as good heart as can those of any other nation.

THESE ARE SOME OF THE WAYS IN WHICH EVERY WOMAN LIVING IN OUR VILLAGES CAN HELP.

1.—You can see to it that your own *gardens and allotments* are better worked and better managed than ever before, and help a neighbour whose husband has gone to the War if she cannot manage her garden by herself.

2.—You can see to it that there is no *waste of fruit*, wild or garden, or of *vegetables* that you can prevent.

3.—Some of you can keep *pigs* and *poultry* and so increase our *home-made food* supplies.

4.—You can help on the farms if needed. If you cannot work all day you may be able to work part of every day. Some of you can milk once or twice a day. Some of you can give your time to be trained to take a man's place.

5.—If you cannot work yourselves, you may be able to mind the children of someone who can.

All can do something. See to it that your name is entered on the Register of Women willing to do their bit of War Service.

French Women are doing all the work of their Farms even where shells are bursting close to them.

It must not be laid to the door of the Women of our Country that, because the men have left to fight for them and for their children, fewer cows are kept, fewer chickens reared, fewer potatoes grown and less land ploughed and sown, so that in consequence food becomes dearer.

COME FORWARD AND DO YOUR BIT.

(The above Appeal has been issued by the Board of Trade and the Board of Agriculture and Fisheries.)

Employment of Soldiers on Agricultural Work.

FARMERS who desire to obtain the assistance of soldiers for work on the land are reminded that they should apply to the local Board of Trade Labour Exchange (the address of which can be obtained from any Post Office) for the necessary application form.

A soldier cannot be released to work continuously on a farm, and not more than four consecutive weeks' furlough will be given to any one man.

If a farmer lives in the neighbourhood of a military station there is no objection to his applying direct to the Commanding Officer for the soldiers whom he requires at short notice and for a period not exceeding six working days.

The other conditions of employment remain the same as was the case last year.

Commanding Officers will meet the demand for soldier labour as far as they are able, but men under training cannot be released nor those required for necessary military duties, and soldiers serving abroad cannot be brought home for this purpose.

Autumn Supplies of Fertilisers.

THE following Circular Letter dealing with Autumn Supplies of Fertilisers was addressed by the Board to the Secretaries of War Agricultural Committees on 24th May :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to invite the co-operation of your Committee in urging farmers to obtain their autumn supplies of fertilisers during the summer months.

Under existing conditions it is desirable to afford every assistance to railway companies in dealing with heavy traffic, and farmers by giving orders and taking delivery some months in advance will help to prevent congestion later in the year.

Owing to shortage of labour and other reasons, the production of fertilisers will not improbably be reduced ; but the existence of an active demand during the summer will tend to induce makers to maintain their output as far as possible and will prevent any slackening in production due to the accumulation of stocks.

For these reasons, Lord Selborne thinks it may be useful if your Committee will take every opportunity of urging farmers to obtain supplies well in advance of the time when they are actually required for use.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Acreage and Live Stock Returns, 1916.

THE Board have recently published Part I. of the Agricultural Statistics for 1915 (Cd. 8420, price 4*d*.). This Part relates to the Acreage and Live Stock Returns of England and Wales in 1915, with summaries for the United Kingdom.

With regard to the number of holdings of various sizes in 1915, compared with those in 1914, the statistics show an increase in the holdings of 50-100 acres, 100-150 acres, and 150-300 acres, and a decrease in the holdings of 1-5 acres, 5-20 acres, 20-50 acres, and above 300 acres.

Report for 1915 of the Animals Division of the Board.

THE Annual Report for 1915 of the proceedings of the Board under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., has been issued in a more abbreviated form than usual (price 3*d*.). The two chief matters dealt with are the procedure with regard to swine-fever, and the reappearance in 1915 of foot-and-mouth disease.

Fream Memorial Prize.

THE Board of Agriculture and Fisheries have awarded a Fream Memorial Prize, of the value of £7 2*s*. 3*d*., to Mr. Robert C. Broadfoot, Nether Cairn, Kirkconnel, Dumfriesshire, a student of the West of Scotland Agricultural College, Glasgow, who obtained the highest marks in this year's examination for the National Diploma in Agriculture.

Release of Soldiers for Agricultural Work.

THE following Circular Letter, dated 5th June, 1916, has been addressed by the Board of Agriculture and Fisheries to War Agricultural Committees :—

Urgent and Important.

SIR,

1. I am directed by the President of the Board of Agriculture and Fisheries to transmit to you the enclosed copies of a Memorandum* issued by the Army Council stating the conditions on which soldiers may be released for agricultural work, and I am to ask that you will take steps to give publicity to it.

2. I am to invite your special attention to paragraph 8 of the Memorandum and to say that a representative of the War Agricultural Committee should be nominated as soon as possible to act with the Military Officer appointed for the County by the General Officer Commanding-in-Chief, who, with the assistance of the Board of Trade Labour Exchanges will deal with all cases arising in the County. I am to ask that you will inform the Board of the name and address of the representative nominated. The name and address of the Military Officer appointed by the General Officer Commanding will be communicated to you as soon as possible.

3. I am to add that Lord Selborne desires me to urge on your Committee the extreme importance of impressing upon farmers the necessity of making full use of all forms of labour that are available for harvest work. In view of military requirements it will be unwise to rely only upon obtaining the assistance of soldiers, as no absolute guarantee can be given that they will be released. There are, however, many other sources of auxiliary labour that are available, and in this connection I am to call your attention to the various sources mentioned in the Board's circular letter of the 23rd April (A. 266/C). Lord Selborne is confident that a public appeal would produce a large number of offers of assistance from those who are willing to devote part of their spare time or of their holidays to harvest work, if they are assured that there is a real demand from farmers for their services, and he will be glad if the War Agricultural Committee will take steps to organise this source of labour supply in your County and to assist farmers to avail themselves of it.

I am to enclose a copy of a poster† which your Committee may think it useful to issue in this connection, copies of which will be supplied from this Office on application.

I am, &c.,
SYDNEY OLIVIER, *Secretary*.

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* Printed immediately below. † Printed below, "Harvest Labour."

THE following Notice on the Employment of Soldiers on Agricultural Work has been issued by the War Office :—

Employment of Soldiers on Agricultural Work.

1. The provision of soldiers for agricultural work is solely intended as a temporary expedient to meet a shortage of labour and to assist *the farmer at the more important seasons* of the year. A soldier cannot be released under these conditions to work continuously on a farm.

2. A farmer may apply for his son or one of his former men by name, but there is no certainty that the man can therefore be allowed away. It is recommended that he should, when sending in his application, ask for another man to be sent instead in case the particular one he would like to have is not available.

3. Soldiers serving abroad cannot be brought home for this purpose.

4. The fact of a soldier being on home service does not by any means indicate that he can be allowed away; men under training cannot be taken, nor those required for necessary military duties, and it must be understood that any soldier is liable to instant recall if required.

5. A man who has recently been called up for military service cannot be allowed away.

6. It is probable that greater facilities for procuring men will be found to exist in certain localities than in others, owing to the number of troops quartered in that *neighbourhood. The request which has been put forward, that men should be* stationed in their own county and thus be available to help the farmers they know, is quite impracticable owing to military requirements.

7. The importance of supplying soldiers whenever they are available, within the limits which have been indicated, has been impressed upon the military authorities.

8. Assistance and advice can be obtained by a farmer from the representative of the War Agricultural Committee of the County Council, who is in close touch with a military representative. These representatives, with the aid of the Board of Trade Labour Exchanges, should be in a position to deal with all cases referred to them, and the farmer should not find it necessary to write to the Board of Agriculture nor the War Office, where the particular local conditions are not so well known.

9. In the case of a farmer living in the neighbourhood of a military station, there is no objection to his applying direct to a C.O. for military labour which he requires at short notice and for a period not exceeding six working days. This may enable the farmer to take advantage of fine days or short intervals of fine weather suitable for his work. The Labour Exchange should subsequently be informed by the C.O. when such a demand has been met.

In all other cases, farmers will apply for the number of soldiers they require to the local Board of Trade Labour Exchange, and will fill up a form of application which can be obtained from that office. The address of local Labour Exchanges can be obtained at the nearest Post Office.

10. If the farmer's requirements cannot be met by civil labour, the Labour Exchange will send on the application to the military centre as advised by the local military representative.

11. The C.O. applied to will, as far as he is able, meet the demand, informing the Labour Exchange, with the least possible delay, to what extent he is going to do so, and at the same time return the form of application.

He will communicate direct to the farmer as to the number of men being sent, the date, and train by which they will arrive.

If he is unable to provide the men, he will at once return the application to the Labour Exchange, explaining why they are not available.

12. Application may be made for men for any class of farm work, and the nature of the work should be specified on the form of application to enable a C.O. to select a suitable man so far as is possible.

There is no guarantee, however, that an experienced man will be sent.

13. Not more than four consecutive weeks' furlough can be given to any one man.

14. A military travelling warrant may be issued for the railway journey coming and going, the arrangements for the conveyance between the railway station and the farm being made by the farmer at his own expense.

15. The farmer will provide all necessary tools and appliances.

16. The hours of work will be those customary in the district.

17. For work in England and Wales at other times than at the corn harvest, each soldier sent at the farmer's request will be paid by the farmer 4*s.* a day if the soldier provides his own board and lodging, or 2*s.* 6*d.* a day if board and lodging is provided by the farmer.

The rates for the corn harvest will be as follows:—

(*a*) Cambridgeshire, Essex, Huntingdonshire, Isle of Ely, Lincolnshire, Norfolk, Soke of Peterborough, Suffolk, the East and West Ridings of Yorkshire and Rutland, 6*s.* for a day of 10 working hours if the soldier provides his own board and lodging, or 4*s.* 6*d.* if board and lodging is provided by the farmer, with 6*d.* an hour overtime.

(*b*) For the remaining counties in England and Wales: 5*s.* for a day of 10 working hours if the soldier provides his own board and lodging, or 3*s.* 6*d.* if board and lodging is provided by the farmer, with 5*d.* an hour overtime.

For men employed in Scotland the rates for corn harvest will be 5*s.* 6*d.* for a day of 10 working hours if the soldier provides his own board and lodging, or 4*s.* if board and lodging is provided by the farmer, with 6*d.* an hour overtime.

For work in Scotland other than corn harvest the rates will be 4*s.* 6*d.* a day if the soldier provides his own board and lodging, or 3*s.* if board and lodging is provided by the farmer.

The above rates to be inclusive of all allowances and to be paid wet or fine.

18. The soldier's Army Pay during the days on which he receives civil pay from the farmer will be regarded as included in the civil pay.

The soldier will be credited with his Army Pay for any Sunday included in the furlough, if he is not given civil pay for that day.

19. He will receive no lodging allowance, rations, or ration allowance from Army Funds, nor will he be billeted. If separation or family allowance was being issued before the soldier's employment on farm work it will continue to be issued during his absence. Family allowance will be at the rate under paragraph 123 (*b*) Separation Allowance Regulations. The separation allowance will be issued in full, the allotment being debited as usual.

20. Soldiers injured while in the farmer's employ will have no claim to Army Pension, but will be dealt with under the Workmen's Compensation Act, the farmer insuring as for the rest of his labour. They will continue as soldiers for Health Insurance, and the farmer will pay no contribution for this.

21. The farmer is at liberty to dismiss a man on giving one day's notice or one day's wages in lieu thereof, and the man's furlough will thereupon be considered as cancelled, and he will return at once to his unit.

22. Army Form W 3151 A, a separate copy of which each man is to take with him from his unit, should in all cases be sent by post by the farmer to the O.C. the unit as soon as a soldier leaves his employment.

23. The Regimental Paymaster will be informed in Part II., Regimental Orders (Army Form O 1810) of the names of all men employed on farm work under the terms of this letter, the date of their employment, also the date of their return to military duty, in order that the necessary deductions of Army Pay may be made in their account.

24. A careful record will be kept by each unit of the number of men supplied, and the period of their employment.

IT will be a great source of strength to England and Wales in this year of War if the harvest is gathered in as good condition and with as little delay as possible.

Harvest Labour. Many farmers will require extra labour to enable them to do this.

Remember that there are thousands of schoolmasters, public school boys, clerks, and men over military age, who are eager to help their country in this way if they are only asked, and farmers who are short of labour are urged to make full use of their services as well as of the services of women.

Information and assistance in obtaining harvest labour of the kind mentioned above may be obtained from the Secretary of the County War Agricultural Committee.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Report of the Women's Mission to French Farms.—THE Women's Mission, promoted by the Berkshire Committee on "Women and Farm Labour," which proceeded to France in February last to ascertain the part played by French women in agricultural work during the war has now issued its Report.* The Mission finally consisted of eight persons, viz., Mrs. Boyce of Windlesham, Surrey (wife of a small holder), Miss Chillingworth of Barn Elm Farm, Bradfield, Berks (daughter of a farmer), Mrs. Saint of High Street, Stone, Staffs (daughter of a farmer), Mrs. Stocks, of 75, Wantage Road, Reading (wife of a clerk), Mrs. Sutherland (daughter of a New Zealand farmer), Miss La Mothe, of the Board of Trade, Miss G. Pott, Hon. Treasurer of the Berkshire Committee on "Women and Farm Labour," and Professor Salmon of University College, Reading.

Leaving London on 23rd February, the party visited the following villages and towns, most of which were within the military zone:—Chateau Thierry, Etampes, Epernay, Chouilly, Fère Champenoise, Troyes, Estissac, Thuisy, Chernegy, Langres, St. Geosmes, Champigny-les-Langres, and Montigny-le-Bretonneux. The number of farms visited was somewhat smaller than originally contemplated, but the deputation were satisfied that those seen were typical of the majority of others in the same neighbourhood, and might fairly be regarded as representative of the agricultural life of the respective districts. In general the farms were small, varying in size from 40 to 120 acres, and were of the type normally worked by the proprietor and his family.

Cows, usually permanently housed owing to the absence of pasture land, were found on all the farms. Sheep were less common, but in some cases a few were found in sheds. Each household made its own butter and cheese as well as sufficient wine or cider for the owner's use. Rabbits were invariably kept for family consumption. Some machinery was seen, but a great deal had been destroyed by the Germans, and there had been no possibility of replacing it.

The Report contains a series of illustrated short notes on a selection of the farms visited. The following examples may be taken as being typical:—

At Chouilly the Mission visited a small holding consisting of about 50 acres of arable land with an additional 10 acres of vineyard, the latter being situated some distance away from the farm. The owner, Madame Mornian, has one child who attended school. Before the war her husband usually worked both farm and vineyard with the assistance of another man. Since 1914, when both had been mobilised, Mme. Mornian had carried on the work with occasional help in the field. She owned six cows and managed all the milking herself. A few sheep were kept stalled; also rabbits and fowls. Until the war, Mme. Mornian had never pruned the vines, but since her husband had been away she had undertaken the whole cultivation of the vineyard.

At Chernegy, near Estissac, the farm of Madame Cottell and Madame Veuve Moret-Cottell was visited. M. Cottell had gone to the front, and

* Copies of the Report may be obtained from the Secretary of the Berkshire Committee on Women and Farm Labour, Shire Hall, Reading, price 3*s.* per doz., post free. Single copies, 6*d.*, post free.

his wife, her sister and their old mother were carrying on the work of two farms of about 160 acres. The household produced all its own bread, meal, wine and cider, cheese, butter, milk and oil. The corn was ground by a miller at Estissac and sifted at home, the coarser part being used as food for the stock. Cows, pigs, fowls and rabbits were kept.

The following points were generally agreed upon by members of the Mission as including the most useful and practical conclusions drawn from their various observations and experiences :—

1. The immediate and unremitting energy displayed by the French women in carrying on all forms of work upon the land from the moment the men were called up to the army. Not only the wives and daughters, *but also the mothers of soldiers undertook the continuance of production* of food without delay. Many aged women, whose advanced years would naturally have earned for them complete rest, were found taking an active share in the roughest labour.

2. The aptitude and willingness shown by women of all ages in undertaking the heavier forms of farm work. Though most of the French peasant women visited were used to assisting the men in the lighter portions of agricultural operations many instances were found of women now carrying on work to which they were unaccustomed before the war. One of the most striking of these instances was that of a soldier's wife who had never touched a plough until her husband and brother were mobilised but who, after two days' lessons from the brother, had ploughed and sown some 50 to 70 acres without assistance. This woman was engaged in teaching her daughter of 12 years old to handle the plough and manage two somewhat ill-tempered horses.

3. That French women appear to accept the carrying on of extra agricultural work as their natural and proper share of the hardships of war. They are to-day fulfilling these tasks without murmur, and their attitude in the matter formed a valuable lesson to their English sisters.

4. The far wider resource and greater economy shown by French country women than is generally practised in English villages. More use is made of garden and wild vegetable produce, not only for human food but also as nourishment for animals. Domestic duties are more generally shared by the whole household than left to one member of the family as is often the case in England.

5. The remarkable productivity of the farms visited as regards the various food commodities consumed by the family, and the consequent self dependence of the French agricultural household was constantly noticed. Though the English agricultural worker cannot produce his own flour and cheese as does the French peasant proprietor, the latter's careful storage of dried beans and peas and use of wild salads might well be imitated in our own villages.

6. The large number of domestic animals reared by French women : every house visited owned a rabbit-hutch and reared rabbits as well as fowls in great quantities. The rabbits were fed almost entirely on wild herbage gathered by the women and children from the roadside, and there would seem to be no adequate reason why so useful and inexpensive a form of animal food should not be more widely cultivated in England. As one French woman was heard to remark : "If one has rabbits and fowls, one need never lack a Sunday dinner."

7. The extreme simplicity of family life as witnessed in the villages visited. The absence of all display of luxury in furniture and food, and

the apparent contentment with which the agriculturists live far removed from town life with its attendant amusements, was often remarked by members of the Mission. There was good reason to believe that a great many of the families seen were possessed of comfortable sums in the savings banks, but there appeared to be no desire or intention on the part of owners to spend such money on the increase of personal luxury, or to relax the hard work and long hours spent daily throughout their lives in the performance of their household and agricultural duties.

8. The custom in some districts of relieving the working mothers of the care of children of school age by arranging for their superintendence at the school for the entire day during the busiest agricultural seasons was interesting. It appears probable that some such arrangement might be introduced with advantage into English villages during the present emergency.

Importation of Plants into France.—The Board of Agriculture and Fisheries desire to draw the attention of nurserymen and others concerned to the fact that the French Government have issued a Decree prohibiting the importation of the following categories of nursery and hothouse plants and shrubs:—Aroids, amaryllids, araliads, aspidistras, azalea indica, begonias, bromeliads, camellias, cycads, cyclamens, crotons, dracaenas, hothouse ferns, selaginellas, marantas, ophiopogons, orchids, palms, pandanads, phormiums.

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for May, 1916, issued by the International Institute of Agriculture, contains information regarding the sowing of winter cereals in the Northern Hemisphere. The areas estimated to have been sown with winter *wheat* in 1915-16, compared with the areas sown during the corresponding period in 1914-15, expressed as percentages, are as follows: Denmark 100, France 91, England and Wales 94, Italy 94, Rumania 101, Switzerland 107, Canada 85, United States 79, British India 94, Japan 122; with *rye*: Denmark 100, France 89, Italy 101, Rumania 116, Switzerland 105, United States 97; with *barley*: France 67, Italy 100, Rumania 92, Switzerland 109, Japan 96; with *oats*: France 88, Italy 102, Switzerland 110. The condition of winter crops in France is generally satisfactory, while the condition is fairly good in the United Kingdom, Italy, the Netherlands, and Switzerland. Plentiful snow in March served to protect the crops in Canada, and winter killing was consequently less extensive than usual.

France.—The Minister of Agriculture estimates that the yield of wheat this year will be 1,789,400 qr., as compared with 1,968,000 qr. last year, and 2,232,000 qr. in 1914. (*The London Grain, Seed and Oil Reporter*, 23rd May.)

United States.—The Crop Reporting Board of the Department of Agriculture, in a report dated 8th June, states that the average condition of winter wheat on 1st June was 73·2 as compared with 82·4 the average condition on 1st June in the past ten years; spring wheat, 88·2 against 93·9; oats, 86·9 against 89·6; barley, 86·3 against 90·7; and rye, 86·9 against 90·2 the ten-year average. From preliminary returns the acreage of spring wheat is estimated at 17,851,000 acres,

or 91·8 per cent. of the acreage harvested last year; oats, 40,599,000 acres, or 99·6 per cent. of last year's acreage; and barley, 7,757,000 acres, or 104·9 per cent. of last year's acreage —(*The London Grain, Seed and Oil Reporter*, 8th June.)

Russia.—According to reports received by the Department of Rural Economy and Agricultural Statistics the condition of winter crops in European Russia, on the 28th April, was extremely favourable. Over a large district crops were considered extremely satisfactory and often good, and in other districts they are generally satisfactory, only a few districts reporting moderate crops. In the north, however, the crops were not clear of snow at the date of the reports. In all districts the early-sown crops turned out best.

The conditions prevailing during the first half of the spring were, in general, highly favourable both for the preparation of the land and spring sowing. In South Russia the crops have germinated and there is an even plant in many localities. (*Broomhall's Corn Trade News*, 23rd and 25th May.)

Canada.—The High Commissioner for Canada, in a report dated the 19th May, states that the crop outlook in Western Canada is encouraging. Splendid progress has been made with seeding operations, and there is promise that a larger area will be sown than was believed possible earlier in the season. A later report, dated 26th May, states that conditions during the week ending 19th May over the Prairie Provinces were generally favourable for sowing, and the area sown was approximately as follows: Manitoba, wheat, 85 per cent., other grains, 25 per cent.; Saskatchewan, wheat, 90 per cent., other grains, 40 per cent.; and Alberta, wheat, 100 per cent., other grains, 75 per cent.

Argentina.—Rains have been copious over practically all of the cereal and pastoral zone of the Republic during the past week. Pastures are improving, and with them the condition of cattle. The harvesting of maize is proceeding normally. Preparation of the soil for the next sowing has been greatly facilitated by the much-needed rains. (*The Review of the River Plate*, 28th April.)

Agricultural Conditions in England and Wales on 1st June.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st June, state that the wheat crop improved during the month, and is now generally healthy and vigorous; with the exception of some areas which had suffered from the wet during the winter, barley and oats have germinated satisfactorily, and both are generally looking well, although in the north oats appear to be the better of the two; the late sown also is mostly not so good as that put in early. The area under barley is slightly less than in 1915, but that under oats is about the same. Beans are very generally a strong and healthy crop; peas are more variable, but are doing well on the whole in most districts.

Potato planting has been very late, and is not yet completed in the north. Very little of the main crop is as yet showing above ground, but what is up appears to be satisfactory, and the early kinds are

locking well. Very little damage from frost is reported. The area planted is somewhat below last year's acreage perhaps by nearly 5 per cent.

Sowing of mangolds is not yet completed. Heavy land has not worked well, but elsewhere the crop has generally gone into a satisfactory seed bed. Where showing, there appears to be a good plant. Very little turnip sowing has yet been done, but most of the land has now been got ready for this crop.

The weather of May has generally suited hops, which grew well during the month, and the bine is mostly healthy and vigorous, but backward in some cases. Insect attacks are not reported to be serious as yet, with few exceptions, although some washing has been done. The area under hops is reported to be less than last year, possibly by 8 to 10 per cent.

Reports of the hay crop, both seeds and meadow are universally good Seeds hay is expected to give a yield 5 to 10 per cent. above the ten-year mean, and meadow hay should also be 5 per cent. above the average. In both cases also, the area intended for mowing is slightly above that of last year.

Prospects for small fruit are generally good, strawberries, raspberries, currants and gooseberries all promising to be over average on the whole, although, as usual, several districts report poorer crops. Orchard fruit is less satisfactory, insect attacks doing considerable damage, more especially to apples and pears, which are expected to be below average, particularly in the south-east of the country; in the north, prospects are better. Plums promise about an average crop—poor in the south-east, but generally good elsewhere, while cherries are good.

Pastures have now plenty of grass, and live stock have generally done well during the month.

Agricultural Labour in England and Wales during May.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st June, the deficiency in the supply of labour was still greatly felt, and it was difficult to keep the fields clean. Women were being employed to some extent in nearly every district. The following are summaries for the different districts :—

Northumberland, Durham, Cumberland and Westmorland.—Farm workers were very scarce, and wages were rising. It was thought that some land, which would have been put under roots, will be left fallow in consequence.

Lancashire and Cheshire.—The supply of labour was deficient, and the shortage was expected to be felt acutely when hay-making begins. Some female labour was utilised in parts of Cheshire for potato planting.

Yorkshire.—Complaint was made of the scarcity of horsemen, and generally the supply of labour was deficient.

Shropshire and Stafford.—Labour was very scarce throughout the district, and no casual labour was to be obtained.

Derby, Nottingham, Leicester and Rutland.—Labour was everywhere reported to be deficient. In a few districts the employment of women on the land was reported.

Lincoln and Norfolk.—The supply of labour was very deficient, but women were being employed more extensively in some districts.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was getting more deficient; wages were raised 1s. per week during May in many districts.

Bedford, Northampton, and Warwick.—The deficiency in the supply of labour was being keenly felt, and turnip sowing was being delayed. Very little hoeing was being done and crops were suffering in consequence.

Buckingham, Oxford, and Berkshire.—Labour was scarce, especially skilled men, but women were being employed for light work.

Worcester, Hereford, and Gloucester.—The supply of labour was very deficient. The employment of women was reported from several districts, and there was a tendency for wages to rise.

Cornwall, Devon, and Somerset.—Labour was very scarce throughout the division, and the employment of women did not appear to be much in evidence in most parts.

Dorset, Wiltshire, and Hampshire.—Labour was very scarce throughout the district. Little hoeing could be done and the hay harvest presents considerable difficulties. Wages were increasing.

Surrey, Kent, and Sussex.—Labour was very scarce throughout the district.

Essex, Hertford, and Middlesex.—The supply of labour was deficient and the usual cleaning of the land was not being done in many instances.

North Wales.—Labour was deficient throughout the district and wages were rising in some districts.

Mid Wales.—There was a scarcity of farm workers, both skilled and casual.

South Wales.—The deficiency was now being keenly felt; in some districts women were giving assistance, but female labour was not easy to obtain.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st June, 1916, certain diseases of animals existed in the countries specified:—

Austria (on the 26th April).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of April).—Anthrax, Foot-and-Mouth Disease (88 outbreaks), Foot-rot, Swine Erysipelas, Swine Fever.

France (for the period 7th—20th May).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—30th April).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of April).—Anthrax, Foot-and-Mouth Disease (2 outbreaks), Foot-rot, Glanders, Swine Erysipelas.

Hungary (on the 26th April).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 8th—14th March).—Anthrax, Blackleg, Foot-and-Mouth Disease (880 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of April).—Anthrax, Blackleg,

Rumania (for the period 14th—21st April).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of Dec.*).—Anthrax, Foot-and-Mouth Disease (48,493 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of Feb.*).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of April*).—Anthrax, Blackleg, Foot-and-Mouth Disease (1 outbreak).

Switzerland (*for the period 15th—21st May*).—Anthrax, Blackleg, Foot-and-Mouth Disease (14 "étables" entailing 33 animals, of which 3 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during May.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending May 6th:								
England, N.E. ...	45·4	−1·4	1·13	29	+19	4	3·5	−2·3
England, E.	51·7	+3·2	0·32	8	− 2	3	5·1	−1·1
Midland Counties ...	48·4	0·0	0·93	24	+13	4	3·2	−2·4
England, S.E. ...	54·9	+5·2	0·68	17	+ 7	5	4·6	−1·7
England, N.W. ...	47·3	−0·8	1·13	29	+16	4	4·7	−1·0
England, S.W. ...	51·5	+2·6	0·91	23	+ 9	5	2·9	−3·4
English Channel ...	54·2	+8·9	0·55	14	+ 3	4	3·5	−4·1
Week ending May 13th:								
England, N.E. ...	47·2	−0·6	1·11	28	+17	5	2·6	−3·7
England, E.	49·0	−0·6	1·13	29	+19	6	2·2	−4·3
Midland Counties ...	47·7	−1·8	0·86	22	+12	5	2·1	−3·9
England, S.E. ...	49·2	−1·7	1·00	25	+16	5	2·6	−4·1
England, N.W. ...	47·2	−2·0	0·85	22	+10	6	3·0	−3·3
England, S.W. ...	47·9	−2·4	0·95	24	+12	6	3·3	−3·5
English Channel ...	50·0	−1·8	0·85	22	+13	7	4·1	−4·2
Week ending May 20th:								
England, N.E. ...	55·1	+6·1	0·12	3	− 7	2	7·4	+1·0
England, E.	55·3	+4·3	0·13	3	− 8	1	9·0	+2·3
Midland Counties ...	56·5	+5·7	0·13	3	− 9	3	7·6	+1·6
England, S.E. ...	56·0	+3·6	0·08	2	− 8	1	8·8	+2·0
England, N.W. ...	56·0	+5·4	0·27	7	− 6	2	7·6	+1·0
England, S.W. ...	55·4	+3·7	0·22	6	− 6	2	6·8	0·0
English Channel ...	56·2	+3·1	0·05	1	− 9	2	7·8	−0·3
Week ending May 27th:								
England, N.E. ...	54·9	+4·1	0·16	4	− 6	2	6·3	−0·2
England, E.	57·1	+4·3	0·22	6	− 5	1	7·6	+0·7
Midland Counties ...	56·2	+3·6	0·40	10	− 3	2	6·8	+0·7
England, S.E. ...	56·2	+2·1	0·16	4	− 7	2	8·8	+1·9
England, N.W. ...	54·2	+1·9	0·74	19	+ 6	4	5·3	−1·3
England, S.W. ...	54·2	+1·0	0·73	19	+ 6	4	5·8	−1·0
English Channel ...	56·3	+1·9	0.28	7	− 5	2	7·7	−0·3

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	39	41	279	326
Animals attacked	43	46	324	363
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	—	3	21	14
Animals attacked	—	3	62	19
Parasitic Mange:—				
Outbreaks	149	109	1,383	*332
Animals attacked	277	225	3,216	*751
Sheep-Scab:—				
Outbreaks	6	11	173	155
Swine Fever:—				
Outbreaks	510	448	2,156	1,840
Swine Slaughtered as diseased or exposed to infection	1,750	2,250	6,887	8,339

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	APRIL.		MAY.		FIVE MONTHS ENDED MAY.	
	1916.	1915.	1916.	1915.	1916.	1915.
Anthrax:—						
Outbreaks	—	—	1	—	2	1
Animals attacked	—	—	1	—	6	1
Foot-and-Mouth Disease:—						
Outbreaks	—	—	—	—	—	—
Animals attacked	—	—	—	—	—	—
Glanders (including Farcy):—						
Outbreaks	—	1	—	—	—	1
Animals attacked	—	3	—	—	—	3
Parasitic Mange:—						
Outbreaks	6	4	1	6	29	23
Sheep-Scab:—						
Outbreaks	29	43	12	22	213	240
Swine Fever:—						
Outbreaks	48	37	23	19	130	121
Swine Slaughtered as diseased or exposed to infection	249	219	146	113	689	739

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in May and April, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	MAY. First Quality.	MAY. Second Quality.	APRIL. First Quality.	APRIL. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	15 5	14 8	13 10	12 10
Herefords	15 11	14 8	13 6	12 7
Shorthorns	15 4	14 2	13 6	12 6
Devons	15 1	13 5	13 5	12 0
Welsh Runts	—	—	12 11	12 3
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	14	11¾	12½	11¼
Sheep:—				
Downs	14	13	14	12¾
Longwools	13	12	12½	11½
Cheviots	14½	12¾	14¼	12¾
Blackfaced	14	12	14	12½
Welsh	13¾	12¼	14	12¼
Cross-breds	14	12¾	13¾	12½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 7	11 11	12 7	11 10
Porkers	13 3	12 9	13 2	12 6
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	32 15	26 7	31 7	24 19
,, —Calvers ...	31 7	25 15	30 1	23 12
Other Breeds—In Milk ...	29 7	23 13	27 19	24 0
,, —Calvers ...	19 10	18 0	20 0	18 10
Calves for Rearing	3 8	2 14	2 19	2 5
Store Cattle:—				
Shorthorns—Yearlings ...	15 1	13 1	13 19	11 19
,, —Two-year-olds...	22 7	19 10	19 12	17 0
,, —Three-year-olds	29 17	25 3	25 17	21 17
Herefords —Two-year-olds...	24 0	20 7	24 2	21 0
Devons— ,,	25 2	21 16	23 5	18 9
Welsh Runts— ,,	21 5	19 0	18 19	16 7
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	71 8	63 0	68 1	58 9
Store Pigs:—				
8 to 12 weeks old	37 5	29 5	31 8	24 8
12 to 16 weeks old	56 1	45 0	49 1	38 4

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in May, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English ...	1st	109 0	105 0	—	106 6	103 6
	2nd	103 6	100 6	—	103 0	97 6
Cow and Bull ...	1st	100 6	98 0	93 0	93 6	92 6
	2nd	92 0	87 0	82 0	88 6	85 0
Irish: Port Killed ...	1st	103 6	—	102 0	104 6	101 0
	2nd	99 6	—	96 6	101 0	96 6
Argentine Frozen—						
Hind Quarters ...	1st	92 6	—	98 0	92 6	98 0
Fore ,, ...	1st	78 0	—	88 6	77 6	88 6
Argentine Chilled—						
Hind Quarters ...	1st	103 0	99 6	102 0	102 6	102 6
Fore ,, ...	1st	85 0	81 0	85 6	83 0	85 6
Australian Frozen—						
Hind Quarters ...	1st	84 0	—	87 6	—	87 6
Fore ,, ...	1st	76 0	—	76 0	—	76 0
VEAL :—						
British ...	1st	112 0	—	—	130 6	—
	2nd	101 6	—	95 0	106 6	84 6
Foreign...	1st	—	—	—	—	—
MUTTON :—						
Scotch ...	1st	—	—	130 6	128 6	131 6
	2nd	—	—	111 0	120 0	123 0
English ...	*1st*	*128 0*	*123 0*	—	*121 6*	*123 0*
	2nd	117 6	112 0	—	114 0	111 0
Irish: Port Killed ...	1st	118 0	—	—	—	115 0
	2nd	116 6	—	—	—	106 0
Argentine Frozen ...	1st	95 0	92 6	92 6	93 6	92 6
Australian ,, ...	1st	—	88 6	81 6	81 0	81 6
New Zealand ,, ...	1st	—	—	—	82 6	—
LAMB :—						
British ...	1st	139 0	149 6	145 6	142 0	143 6
	2nd	129 6	140 0	127 0	132 6	129 6
New Zealand ...	1st	94 0	—	97 6	90 6	95 0
Australian ...	1st	92 0	—	93 6	90 6	93 6
Argentine ...	1st	112 0	103 0	105 6	105 0	105 6
PORK :—						
British ...	1st	109 6	103 6	102 0	104 0	97 6
	2nd	106 0	98 6	92 6	95 6	90 6
Frozen ...	1st	87 0	84 0	82 6	82 6	82 0

AVERAGE PRICES of PROVISIONS and POTATOES at certain MARKETS in ENGLAND in May, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	19 9	18 9	—	—	18 0	17 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	165 0	162 0	165 0	161 6	166 0	162 0
" Factory	140 0	130 0	139 0	129 0	144 0	134 0
Danish...	—	—	173 0	170 6	173 0	169 6
French...	—	—	—	—	155 6	150 6
Russian	133 0	125 0	—	—	135 0	127 0
Canadian...	—	—	—	—	—	—
Australian	162 6	158 6	—	—	161 6	157 6
New Zealand	170 6	168 6	170 0	168 0	167 6	165 0
Argentine	161 0	157 0	—	—	160 0	156 0
CHEESE:—						
British—						
Cheddar	116 6	114 6	116 0	114 0	119 6	115 6
			120 lb.	120 lb.		
Cheshire	—	—	112 0	106 6	—	—
			per cwt.	per cwt.		
Canadian	114 0	112 0	111 0	109 0	113 6	111 6
BACON:—						
Irish (Green)	115 0	111 0	112 6	110 0	112 0	108 0
Canadian (Green sides)	99 6	96 0	99 6	96 0	101 0	97 0
HAMS:—						
York (Dried or Smoked)	160 0	156 0	—	—	160 0	154 0
Irish (Dried or Smoked)	—	—	—	—	150 0	140 0
American (Green) (long cut)	90 0	87 0	90 0	87 6	91 0	88 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	14 4	—	—	—	15 2	14 2
Irish	14 0	—	14 2	13 5	14 8	14 1
Danish	—	—	—	—	16 10	15 0
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	190 6	171 6	153 6	143 6	197 0	182 6
Up-to-date	177 0	156 6	151 6	141 6	187 6	176 0
Other Late Varieties...	177 0	146 0	156 6	148 6	190 0	175 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.			BARLEY.			OATS.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 8...	30 11	46 2	55 8	25 11	29 7	47 8	18 4	26 5	31 5
„ 15...	31 0	48 9	56 7	26 0	30 5	48 6	18 6	27 6	31 11
„ 22...	30 11	51 6	57 2	26 3	31 3	49 6	18 11	28 10	32 6
„ 29...	31 1	52 8	58 0	26 6	32 5	51 0	19 1	29 10	32 11
Feb. 5...	31 0	53 3	58 3	26 7	33 7	52 5	18 9	30 3	32 4
„ 12...	31 0	54 8	57 6	26 7	34 7	52 10	18 11	31 1	32 2
„ 19...	31 0	56 0	56 11	26 7	34 11	53 6	18 11	31 5	31 9
„ 26...	31 0	56 0	58 2	26 6	35 3	54 2	18 11	31 8	32 2
Mar. 4...	31 5	55 11	59 4	26 2	34 6	55 7	18 9	31 8	32 4
„ 11...	31 6	54 8	58 2	26 0	33 5	55 6	18 7	31 0	32 3
„ 18...	31 5	53 9	57 9	25 8	32 2	55 4	18 6	30 7	31 10
„ 25...	31 4	54 3	55 11	25 7	31 11	54 6	18 8	30 6	31 4
Apl. 1...	31 6	54 6	53 6	25 6	31 9	53 8	18 5	30 6	30 5
„ 8...	31 5	54 9	51 8	26 8	31 3	53 7	18 4	30 4	30 1
„ 15...	31 7	55 4	53 2	25 4	30 10	53 1	18 4	30 5	30 7
„ 22...	31 9	56 5	55 3	26 6	31 5	52 10	18 5	30 11	31 8
„ 29...	31 9	58 3	56 3	26 0	32 7	53 5	18 5	31 5	32 4
May 6...	32 2	60 5	55 7	25 6	33 3	53 1	18 9	32 4	32 10
„ 13...	32 7	61 7	55 5	26 3	34 0	53 5	18 11	32 5	33 1
„ 20...	33 0	62 0	55 0	25 10	34 1	52 10	19 0	32 8	33 0
„ 27...	33 9	61 11	54 7	26 1	34 8	52 9	19 4	32 7	33 4
June 3...	34 0	61 9	53 3	25 11	35 4	53 9	19 4	32 5	33 3
„ 10...	34 1	60 1		24 11	34 5		19 8	32 4	
„ 17...	34 1	56 1		25 10	34 3		19 9	31 9	
„ 24...	34 3	52 0		25 4	34 4		20 0	31 9	
July 1...	34 4	49 5		24 6	35 3		19 9	31 1	
„ 8...	34 2	50 1		24 9	34 7		20 0	31 6	
„ 15...	34 1	52 7		24 2	35 8		19 10	31 6	
„ 22...	34 0	53 10		24 7	35 10		19 9	32 1	
„ 29...	34 2	55 3		25 9	36 1		19 8	31 1	
Aug. 5...	34 9	55 4		25 2	35 7		19 1	31 5	
„ 12...	40 3	55 2		29 4	37 0		25 1	31 7	
„ 19...	38 9	54 3		29 10	39 4		24 3	31 4	
„ 26...	36 2	51 11		30 3	38 3		23 5	30 0	
Sept. 2...	36 5	45 3		30 6	38 1		23 9	26 10	
„ 9...	37 10	43 0		29 11	37 11		23 11	26 8	
„ 16...	38 3	42 9		29 5	39 0		23 8	26 4	
„ 23...	37 6	43 3		29 3	39 8		23 3	26 1	
„ 30...	37 1	43 5		29 1	40 4		22 9	26 5	
Oct. 7...	36 8	44 1		28 10	41 0		22 5	26 5	
„ 14...	36 7	45 9		28 8	42 3		22 4	27 1	
„ 21...	37 2	48 2		28 7	44 0		22 5	28 1	
„ 28...	37 10	50 3		28 3	46 2		23 7	29 1	
Nov. 4...	38 8	51 6		28 6	47 3		23 7	30 4	
„ 11...	39 8	52 8		29 0	47 5		24 8	30 11	
„ 18...	41 0	53 6		29 8	47 11		25 5	31 3	
„ 25...	41 11	54 2		30 3	48 7		25 8	31 1	
Dec. 2...	42 2	53 7		30 2	48 11		25 9	30 11	
„ 9...	42 1	52 10		29 11	47 10		25 9	30 4	
„ 16...	42 7	53 11		29 8	47 5		25 9	30 6	
„ 23...	43 3	53 10		29 9	47 2		25 11	30 7	
„ 30...	44 4	54 9		29 10	47 5		26 6	30 10	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of May, 1914, 1915, and 1916.

—	Wheat.						Barley.						Oats.					
	1914.		*1915.*		*1916.*		*1914.*		*1915.*		*1916.*		*1914.*		*1915.*		*1916.*	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	33	8	59	10	54	9	24	9	34	0	51	2	20	6	33	3	33	9
Norwich ...	32	2	60	2	54	1	24	8	33	1	50	7	18	3	32	1	32	10
Peterborough	32	6	60	6	53	8	25	11	33	6	51	5	19	1	32	5	32	6
Lincoln ...	32	11	61	2	55	0	25	6	32	9	54	0	19	3	32	4	32	11
Doncaster ...	32	5	60	4	55	8	24	2	32	9	52	7	18	9	31	5	32	4
Salisbury ...	32	1	59	9	56	9	23	9	34	8	50	3	18	9	33	4	33	0

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THE INFLUENCE OF PALM-KERNEL CAKE ON THE PRODUCTION OF MILK AND BUTTER.

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SINCE the advent of the oil-cakes, few matters relating to their use have been the subject of more frequent controversy than the extent to which the production of milk and butter may be influenced by the use of one or other of these feeding-stuffs.

The great majority of the experiments carried out to test this point have led to the conclusion that, provided the supply of digestible protein (albuminoids), fat and carbohydrates in the ration remains adequate, the substitution of one "cake" for another has but little effect upon the yield of milk, and no measurable effect upon the percentage of fat or of solids other than fat therein. In the case of a few feeding-stuffs, however, the experimental evidence is conflicting, many series of tests having given results which, if reliable, indicate that the materials exercise a specific influence upon the secretion of milk-fat. No feeding-stuff has given rise more frequently to results of this character than palm-kernel cake, and on the Continent, where it is very extensively used, the opinion has become widely and firmly established that the use of this cake for dairy cows leads to an appreciable enrichment in fat of the milk produced.

In view of the wide-spread attention which is now being given to palm-kernel cake (and meal) in this country, and the desirability in the national and imperial interest that this apparently valuable feeding-stuff should be extensively produced and consumed here, it is worth while to examine the experimental evidence on which its claim to special merit as a producer of butter-fat is based.

As mentioned above, the cake has long been used extensively

on the Continent and but little in the United Kingdom, so that we are indebted almost exclusively to Continental experiments for our information regarding its merits. An excellent summary of this work has been given recently[1*] by Professor J. Hansen, Director of the Agricultural Institute of the University of Koenigsberg, and it is upon this that the present article is largely based.

Palm-kernel cake seems first to have come on the market in the early 'sixties of the last century, "this, comparatively speaking, new feeding material" being brought to the attention of farmers by the late Dr. Voelcker in an article in the *Journal of the Royal Agricultural Society*[2] in the year 1865. About the same time references to it began to appear in German agricultural literature, with the lament that the palm-kernel cake made in Hamburg was being exported to England, "because no sale could be obtained for it in Germany."

Voelcker records an apparently unsuccessful attempt to secure a decisive experimental test with palm-nut meal in 1861 at the Royal Agricultural College, Cirencester, and as an apt illustration of the difficulties which then—and, it is to be feared, still—beset the introduction of new feeding-stuffs, his remarks are worthy of reproduction here. After alluding to the common difficulty experienced with well-fed animals in replacing a palatable food by one less palatable, he proceeds: "Palm-nut "meal is certainly not so nice to the taste as linseed cake or "swedes and hay; some difficulty consequently was experienced "in inducing animals to eat it, and neither the cowman nor the "person in charge of the pigs possessed the requisite patience "to give the meal a fair trial, and both declared it to be little "better than sawdust. After repeated attempts to overcome the "prejudice of the cow- and pig-man the meal was consigned to "the granary, where it remained for nearly 10 months. By that "time the store of oil cake was almost consumed, the supply of "roots ran short, and the price of all feeding materials was very "high. Under these circumstances an application for a fresh "supply of oil cake for the use of the sheep was not very favour-"ably received by Mr. Coleman [the farm-manager] who gave "the shepherd liberty to use the despised palm-nut meal. "Probably somewhat stinted in food, the sheep took to the palm-"meal at once, and after a few days ate it up greedily, and, "what is more, throve upon it remarkably well. . . . The "shepherd, indeed, soon learned to profer it to the best linseed-

* The small figures in this article refer to the Summary of Literature given at the end (p. 320).

"cake, and had the satisfaction of getting the first prize for fat "sheep at the Gloucestershire Agricultural Society's Show.

"The success in the sheep-feed paved the way to a more "favourable reception of the palm-nut meal than it received at "the outset on the part of our cowman, who now found that "3 to 4 lb. a day not only increased the quantity of milk, but like-"wise greatly enriched its quality. . . . By degrees this meal "found its way amongst agriculturists; and all who have given "it a fair trial speak in the highest terms of its fat- and milk-"producing properties."

It must be pointed out that the palm-nut kernel meal then produced differed markedly in composition from that now available in being extraordinarily rich in oil, this ranging in 6 samples quoted by Voelcker from 19·95 to 26·57 per cent. Samples of cake and meal of Hamburg make quoted by him contained 9½ to 14 per cent. of oil. These are all figures much higher than those presented by the cakes and meals now being produced in this country, and this fact must not be lost sight of in dealing with the results of the older experiments.

Continental Experiments.—The earliest recorded experiments in Germany were those of Stoeckhardt,[4] published in 1865, reporting favourable results with pigs and milch-cows, though in the case of cows Stoeckhardt could not regard the results as decisive, owing to irregularities in the course of the experiments.

From this time the use of palm-kernel cake spread rapidly in Germany, and favourable notices from practical farmers began to appear in the agricultural press.

The first to submit numerical data in support of the claim that palm-kernel cake has a specifically favourable influence upon the secretion of milk-fat was a practical farmer, Herbst.[5] With his two herds, amounting together to 88 cows, he compared the effects of replacing rape cake (2 lb. per cow per day) by an equal weight of palm-kernel cake (containing 19·80 per cent. of oil). The replacement caused no alteration in the yield of milk, but reduced the amount of milk required to give 1 lb. of butter from 15-16 qt. to 12⅓ qt. An increase of the palm-kernel cake to 3 lb. had no further effect.

In the same year another farmer, von Amsberg,[6] reported the results of a similar comparison of rape cake and palm-kernel cake (2 lb.), made with 7 cows. His results showed a decrease of 5 per cent. in the yield of milk, but an increase of 15 per cent. in the output of butter, the latter being determined on the last two days of each period. Here, again, the palm-kernel cake used was extraordinarily rich in oil.

A further comparison of palm-kernel cake with rape cake ($1\frac{1}{2}$ lb.) was made in December, 1870, by Freitag,[7] with the whole herd of the farm attached to the agricultural institute at Poppelsdorf. The cows received first rape cake for 12 days, then palm-kernel cake for 18 days, and finally rape cake once more for 12 days. The milk was measured daily and analysed on 3 days in each period. The results bore out those recorded above, the yield of milk being practically unaffected by the substitution of palm-kernel cake for the rape cake, whilst the average percentage of fat in the milk was raised from 2·74 per cent. to 3·61 per cent.

Next in point of time follow the experiments of G. Kühn,[8] carried out in 1871-73 at the Möckern Experiment Station, and regarded generally by German writers as amongst the most reliable tests made. The primary object of these experiments was to study the effects of successive increments of food (especially protein) upon the milk secretion. In all, six cows were used, and the "period" system of experiment was followed (*i.e.*, each cow received the foods under test in successive periods, the normal changes due to advance of lactation being deduced from the averages of the first and last periods in which the feeding was identical). The results showed that as the supply of protein was increased the fat content of the milk tended to rise, but that with certain foods—notably palm-kernel meal—the increase in fat-output was more than was to be expected from the increase in food supply. This "specific" influence of the palm-kernel meal was shown by every cow, although the magnitude of the apparent effect varied greatly in the individual cases. The palm-kernel meal used contained only 4·12 per cent. of oil and was given in amounts ranging from $3\frac{1}{3}$ to $6\frac{2}{3}$ lb. per cow per day. Despite the satisfactory concordance of the indications of the individual cows the results of Kühn's experiments cannot be regarded as completely decisive, since the rations used were in some respects abnormal and the number of cows was too small to ensure the elimination of the disturbing factor of individuality.

For the latter reason also little importance can be attached to the experiments of Schrodt and Hansen in 1882, and of Schrodt in 1887, which in each case showed an apparent superiority in fat-production of palm-kernel cake over sunflower-seed cake and ground-nut cake respectively.

The first satisfactory tests on practical lines were those carried out in 1891 and 1892 on eight Danish farms by Fjord and Friis.[9] These tests were made in accordance with the standard plan

of the classical Danish experiments, three groups of 10 cows each being used at each farm. In the preliminary period (20-40 days) all groups were fed alike, and then in the experimental period (50-100 days), along with hay, straw and roots, they received on the average per cow per day:—

	Group A. lb.	Group B. lb.	Group C. lb.
Grain mixture	6·11	4·08	2·05
Oil-cake mixture	2·05	4·08	6·11

The ration of Group B remained identical with that of the preliminary period. The oil-cake mixture consisted of equal parts of rape-cake, palm-kernel cake and sunflower-seed cake, so that the amounts of palm-kernel cake fed in the different groups were 0·68, 1·36 and 2·04 lb. respectively. In a final period of 1-2 months each group was again fed alike, receiving, as nearly as possible, the same rations as in the preliminary period.

The general averages for the 2 years (representing in each group an average of the records of 160 cows) were as follows:—

Yield of Milk per cow per day.

	Group A. lb.	Group B. lb.	Group C. lb.
Preliminary period	28·54	28·54	28·54
Experimental period	23·91	25·24	25·79
Final period	21·71	22·26	22·37

Percentage of Fat.

	Group A.	Group B.	Group C.
Preliminary period	3·26	3·25	3·26
Experimental period	3·22	3·20	3·22
Final period	3·28	3·26	3·28

It will be noted that whereas the oil-cake mixture was clearly superior to the grain mixture for the production of milk, the results show no trace of any specific influence exerted by it upon the production of fat.

It may fairly be urged, however, that the experiment was not designed directly to test the specific influence of palm-kernel cake, and that little specific effect was to be expected from the comparatively small allowance of this cake fed.

A similarly negative result was obtained in the following year by Backhaus [10] in a "period" experiment with 10 cows, in which palm-kernel cake was compared with ground-nut cake and cotton-seed meal. The averages (per head per day) of the 10-13-day periods were as follows:—

	Milk. lb.	Fat. Percentage.	Fat. Yield (lb.).
Ground-nut cake (2·204 lb.)	26·12	2·81	·734
Palm-kernel cake (3·306 ,,)	26·12	2·82	·736
Cottonseed meal (2·204 ,,)	24·02	2·94	·705
Palm-kernel cake (3·306 ,,)	23·69	2·90	·688

These results reveal no specific influence of the palm-kernel cake upon fat production, despite the considerable amount (over 3 lb.) fed. The original report does not state the composition of the cake used, and fails also to give certain other information needed for a full examination of the reliability of the results.

Further results favourable to palm-kernel cake were published by Lehmann in 1895 and 1896, but being based upon the records of only one cow and three cows, respectively, may be passed over as unconvincing, as may also the experiments of Winberg in 1894 with 4 cows, which indicated no specific effect from the consumption of 2·204 lb. of the cake.

More extensive experiments were carried out by Ramm[11] in the winter of 1894-5, using 10 cows and periods of 10 days each. Various concentrated foods were compared, the amount of each taken being such as supplied equal amounts of digestible protein. The palm-kernel cake used contained 11·33 per cent. of oil, and was fed at the rate of 7·91 lb. per 1,000 lb. live-weight. The averages for the individual periods, which came in the order given, were as follows:—

	As Recorded.			*After Correction for Advance of Lactation.*	
	Milk. lb.	*Fat.* lb.	*Fat.* Per cent.	*Milk.* lb.	*Fat.* lb.
Poppyseed cake ..	47·41	1·210	2·55	54·70	1·419
Coconut cake	47·52	1·336	2·81	55·70	1·578
Palm-kernel cake ..	45·14	1·422	3·15	53·65	1·728
Dried grains	48·22	1·402	2·91	58·14	1·715

On the basis of these results, in view of the relatively high figures obtained with dried grains, Ramm classed palm-kernel cake as a food with no specific influence upon milk-secretion, but Hansen draws the opposite conclusion. He points to the increased percentage of fat in the palm-kernel period, and to the fact that it was preceded by a period of feeding with coconut cake, which itself is regarded in many quarters as having a specifically favourable influence upon the secretion of milk-fat. The periods being very short, after-effects of the coconut feeding might have been operative in the palm-kernel period, whilst similarly the records of the dried grains period may have benefited from the after-effects of the palm-kernel feeding. For these and other reasons the results must be regarded as inconclusive with respect to the point at issue.

In later experiments (1899-1900), with 6 cows, Ramm[12] compared palm-kernel cake (10·2 per cent. oil) and palm-kernel meal (3·65 per cent.) with ground-nut cake, and, after correction for

advance of lactation, the following average results per 2,240 lb. live-weight were obtained:—

	Milk. Yield. lb.	Fat. Percentage.	Fat. Yield (lb.).
Ground-nut cake ..	60·28	3·33	2·006
Palm-kernel cake ..	54·59	4·07	2·224
Palm-kernel meal ..	54·92	3·76	2·067

The relative poverty of the palm-kernel foods in protein was doubtless responsible for the fall in milk-yield, but, taken as they stand, the fat results are indicative of a marked specific influence of both the cake and the meal upon fat-production. The scale of the experiment must, however, still be regarded as too small to admit of the results being made the basis of generalisation.

Similar tests made by von Knieriem[13] in 1891 gave the following results (per cow per day):—

Period.	Milk. lb.	Fat. Per cent.
I.—Normal ration (30 lb. clover hay) ..	12·36	3·89
II.— ,, ,, + 5 lb. palm-kernel cake ..	14·28	4·39
III.— ,, ,, ...	11·92	4·36
IV.— ,, ,, + 5 lb. palm-kernel cake ..	13·36	4·50
V.— ,, ,, ...	10·80	3·80

It is clear from the milk-yields that the normal ration of clover-hay was inadequate for the needs of the cows, so that it is difficult to say to what extent the improved quality of milk obtained by the addition of palm-kernel cake was due to purely nutritive effects and how far specific influence upon fat secretion may have been operative.

In 1896-97 Maercker and Albert[14] investigated the effect of increasing supplies of oil upon milk-production, using in certain periods palm-kernel cake containing 12·06 per cent. of oil for the purpose of increasing the oil-consumption. The average results for 5 Simmenthal cows and 5 Altmark cows were as follows:—

	Simmenthal.			Altmark.		
	Milk. lb.	Fat. Per cent.	Fat. lb.	Milk. lb.	Fat. Per cent.	Fat. lb.
Normal ration I...	25·21	3·04	767	48·16	3·03	1·459
,, ,, II...	24·66	3·40	840	46·90	3·13	1·470
Palm-kernel cake ..	26·91	3·76	1·012	44·79	3·39	1·516

Here, again, there is an element of doubt as to the precise significance of the increased output of fat in the palm-kernel period since it may be just as legitimately attributed to the increased supply of oil as to specific influence of the palm-kernel cake upon fat secretion.

No specific influence was traceable in results obtained in 1900 by Vieth[15] in an experiment with two groups of three cows each, but as the palm-kernel meal contained only 2·5 per cent. of oil

and was fed to the extent of 4½ lb. only, this, perhaps, was only to be expected.

The same excuse cannot, however, be offered for the negative, or at best doubtful, results obtained by Lemmermann and Linckh[16] in 1903, in an experiment with 4 cows, since these were fed *liberally* (6 lb. per 1,000 lb. live-weight) with a palm-kernel cake containing 6·4 per cent. of oil. In a critical review of this experiment, however, Hansen suggests that in the short (10-day) periods used after-effects of other foods may have been operative, masking any specific effects. Moreover, the milk-yields were low, and the upland breed (Simmenthal) of cows used has been shown by later experiments to be less responsive to palm-kernel cake than lowland breeds.

It was in the same year that Hansen[17] took up the investigation of the subject of the specific merits of different foods for milk-production in a series of experiments extending over 10 years. These experiments comprise nine separate series, involving 63 cows. The "period" system was adopted throughout and the number of cows in individual experiments ranged from 3 to 11. Where the number of cows was small the experiment was always repeated, palm-kernel cake being tested no fewer than four times. In no case were contradictory results obtained on repetition, although naturally the actual numerical results obtained with individual cows showed great variation. Full details of the experiments are given in the separate reports, and indicate that every precaution was taken to secure accurate results. The individual periods lasted 14 days, of which the first 7 days were regarded as a transitional period, and only the last 7 days as the true experimental period. In all periods of a series the total amount of digestible nutrients fed was the same, the only difference, therefore, between different periods being in the *kind* of food used. The "basal ration" per 1,000 lb. live-weight consisted of 10-12 lb. meadow hay and 50-70 lb. beets (or extracted sugar-beet slices). The foods used as "standards" for comparison were always such as previous experiments had shown to have no specific influence upon milk-secretion (ground-nut cake, wheat bran and barley meal).

In the nine series of experiments 29 feeding-stuffs were tested, but we are concerned here only with the results obtained with palm-kernel cake and meal.

In the winter of 1903-4 an experiment with palm-kernel cake (7·28 per cent. oil) and extracted palm-kernel meal (4·68 per cent. oil) was made with 3 cows, and showed an appreciable superiority in fat-production in both cases as compared with the

This experiment was not in all respects quite satisfactory, however, and, accordingly, was repeated in the following winter with 4 cows. The palm-kernel cake used contained 7·10 per cent. and the meal 1·89 per cent. of oil, each being fed at the rate of 5½ lb. per 1,000 lb. live-weight. The average results were as follows:—

	Milk Yield.	*Fat Yield.*	*Fat, per cent.*
	lb.	*lb.*	
Bran and ground-nut cake ..	34·60 = 100·0	1·137 = 100·0	3·29 = 100·0
Palm-kernel meal	36·12 = 104·4	1·281 = 112·6	3·54 = 107·6
Bran and ground-nut cake ..	32·97 = 100·0	1·087 = 100·0	3·30 = 100·0
Palm-kernel cake	34·62 = 105·0	1·256 = 115·6	3.63 = 110·0

In the following winter (1905-6) a further test was made with a palm-kernel cake containing 7·0 per cent. of oil, this being compared with a mixture of ground-nut cake and rice-meal. Ten cows were used in this series, and each received the palm-kernel cake at the rate of 6 lb. per 1,000 live-weight. The results are summarised below:—

	Milk Yield.	*Fat Yield.*	*Fat, per cent.*
	lb.	*lb.*	
Ground-nut cake	35·40 = 100·0	·844 = 100·0	2·38 = 100·0
Palm-kernel cake	35·51 = 100·3	1·058 = 125·3	2·98 = 125·2

The extraordinary difference here shown in fat production is attributed by Hansen to the use of rice meal in the "standard" mixture, since this had been found in other experiments to exercise a very unfavourable influence upon the fat-content of milk.

In summarising the results of the foregoing three experiments Hansen lays emphasis upon the concordance between the indications of each series and upon the fact that, without exception, the specific influence of the palm-kernel cake is traceable in the records of each of the individual cows. From the fact that an appreciable specific effect upon fat secretion was exercised by the extracted meal containing only 1·89 per cent. of oil, which was used in the second experiment, he concludes that the specific influence is not determined solely by the oil-content, but must be primarily due to special excitant ingredients ("Reizstoffe") present in the food. Since, however, in both series in which cake was compared with meal much poorer in oil the former gave the more pronounced effects, he concludes that the oil-content is also a factor determining the extent of the specific influence on fat-secretion.

During the period covered by Hansen's experiments the results of sundry other experiments were published, but none of sufficient importance to warrant serious notice.

From the foregoing summary of investigations, covering a period of about 40 years, it is clear that even after so many attempts no decisive answer had been obtained to the question

whether the claim that palm-kernel cake could beneficially influence the secretion of milk-fat was justified in fact.

Despite the discrepancies in experimental results the belief that palm-kernel cake does possess this special virtue had undoubtedly found wide acceptance amongst German dairy farmers, and in view of the widespread use of this feeding-stuff it was obviously desirable that some really crucial test should be made.

Accordingly, in 1910, a co-operative experiment on a large scale was organised under the auspices of the Association of German Agricultural Experiment Stations, and carried out at nine centres, involving a total of 186 cows. The results were collected and issued as a combined report,[18] including a general summary by Kellner and the special reports of the individual investigators.

At some centres the group system was used and at others the period system. With two exceptions (Oldenburg and Rostock) palm-kernel cake was compared in each case with an equal supply of nutrients given in the form of a mixture of ground-nut cake and maize. At Oldenburg and Rostock the supplies of nutrients compared were not exactly equal. The results, as re-tabulated by Hansen, are given in the table on p. 315.

These results seem to establish beyond dispute the claim that palm-kernel cake, whilst having but little effect upon the yield of milk, can produce an appreciable increase in the percentage of fat in the milk, and consequently in the total output of milk-fat. The magnitude of the specific effect varies in the different experiments, and even greater variations are recorded in the data for the individual cows. It is clear, therefore, that the individuality of the animals must play an important part in determining the specific effect.

The results apparently furnish evidence of an influence of breed upon the magnitude of the specific effect. Thus at 3 centres (Jena, Triesdorf and Weihenstephan), where an upland breed (Simmenthal) was used, the rise in the average percentage of fat, as compared with the ground-nut and maize average (= 100), ranged from 100·2 to 107·7, whilst at the remaining 6 centres, where lowland breeds were used, the corresponding range was from 103·9 (Greifswald) to 112·1 (Oldenburg); or, if the Greifswald result be omitted, from 109·4 (Danzig) to 112·1. The low response obtained at Greifswald may possibly have been due to the fact that the palm-kernel cake used there contained only 3·85 per cent. of oil, whilst at the other centres of this group the percentages were higher, viz., Rostock 5·58 per cent., Danzig 5·60 per cent., Bonn 6·40 per cent., Hamburg 7·49 per cent., and

Centre.	No. of Cows.	Palm-kernel Cake per Head per Day.	Milk Yield.			Fat-Content.			Yield of Fat.		
			Maize, Ground-nut Cake.	Palm-kernel Cake.	Maize, Ground-nut Cake = 100, Palm-kernel Cake =	Maize, Ground-nut Cake.	Palm-kernel Cake.	Maize, Ground-nut Cake = 100, Palm-kernel Cake =	Maize, Ground-nut Cake.	Palm-kernel Cake.	Maize, Ground-nut Cake = 100, Palm-kernel Cake =
		lb.	lb.	lb.		Per cent.	Per cent.		lb.	lb.	
Bonn	17	7·49	46·95	46·31	98·6	3·24	3·58	110·5	1·521	1·657	109·0
Danzig	20	4·41	22·75	24·02	105·6	2·97	3·25	109·4	·677	·780	115·3
Greifswald	24	4·41	22·06	22·77	103·2	3·05	3·17	103·9	·672	·721	107·2
Hamburg	18	4·85	40·93	40·97	100·1	3·17	3·51	110·7	1·298	1·439	110·9
Jena	20	5·07	22·75	22·66	99·6	3·68	3·85	104·6	·838	·873	104·2
Triesdorf	20	5·51	18·80	18·93	100·7	3·51	3·78	107·7	·659	·716	108·7
Weihenstephan	20	5·73	15·76	15·80	100·3	4·20	4·21	100·2	·661	·666	100·7
Average of 7 Centres	—	5·29	27·13	27·35	100·8	3·40	3·62	106·5	·904	·979	108·3
Oldenburg	15	3·97	12·43	12·85	103·4	3·23	3·62	112·1	·401	·465	115·9
Rostock	24	5·29	26·38	26·49	100·4	3·11	3·46	111·2	·820	·917	111·8
Average of 9 Centres	—	5·29	25·41	25·65	101·0	3·35	3·60	107·8	·838	·915	109·2

last-named centre, where, with lowland breeds, cake richest in oil was used, the greatest relative rise in fat-content was recorded, despite the fact that the cows were 1-2 months further advanced in lactation than the average of the lowland breeds at the other centres, and hence gave relatively low yields of milk and might have been expected to show little response to change of feeding.

Against this may be set the fact that at Weihenstephan, where a cake even richer in oil (9·72 per cent.) was used, the response was not so high as that obtained with the cake poor in oil at Greifswald. The difference in breed of cows used may have partly accounted for this, but the chief factor was undoubtedly the advanced state of lactation of most of the cows at Weihenstephan. At the beginning of the experiment 12 of the cows at this centre were more than 5 months, and 10 cows more than 6 months advanced in lactation, whereas in all the remaining experiments combined, only 12 cows more than 6 months from calving were included. The average stage of lactation of the cows at this centre was 8 months, as compared with 2-4 months at the six centres where lowland breeds were used, 5 months at Jena, and 4½ months at Triesdorf—the two other centres where the upland breed was used. This fact must seriously impair the validity of any conclusions based upon the results as to the influence of breed in determining the magnitude of the specific effect of the palm-kernel cake.

To the British observer the relatively low fat-content of the milk of the lowland breeds used in these experiments is noteworthy, and raises the question whether with the richer milk commonly secreted by the chief British dairy breeds much scope may remain for improvement by the use of palm-kernel cake.

In the winter of 1911-12 Kopp and Thiex carried out an experiment with 17 cows, in which equal quantities (3·306 lb.) of palm-kernel cake and rape cake were compared. The cows first received the rape cake for 14 days, on the last two of which the yield and composition of the milk were determined. The rape cake was then replaced by palm-kernel cake, and 19 days later yield and quality of milk were again determined on two consecutive days. A return was then made to the rape-cake ration and the yield and quality of milk again determined on the 15th and 16th days after the change. The averages (per head per day) of the 17 cows for the three periods were as follows:—

	Milk.	Fat.	
	lb.	*Per cent.*	*lb.*
Period I.—Rape cake	32·42	2·62	·851
„ III.— „	30·64	2·68	·820

The averages were uniformly supported by the records of the individual cows.

In a further experiment with 11 cows in the following winter Kopp[19] compared equal weights (6·612 lb.) of palm-kernel cake and sunflower seed cake. In accordance with the lower protein-supply the milk-yield was somewhat less with the palm-kernel cake, but the fat-content was 2·79 per cent. as compared with 2·44 per cent. and 2·49 per cent. in the preceding and following periods in which the sunflower seed cake was fed.

This experiment was repeated by Kopp[20] in the following winter (1913), using two groups of 10 cows each, with the primary object of determining by a prolonged test whether the reduction in supply of protein on feeding palm-kernel cake caused a permanent reduction of the milk-yield. The amounts of cake compared were increased to 8·816 lb. per cow per day, and the yield and quality of the milk were checked on 7 days throughout the 13 weeks over which the comparison extended. Prior to the experiment the yield and fat-content of the milk were precisely identical for the two groups. The averages for the experimental period were as follows:—

	Milk.	Fat.	
	lb.	*Per cent.*	*lb.*
Group I.—Sunflower seed cake	34·62	2·57	·890
,, II.—Palm-kernel cake	34·16	3·27	1·120

The increase in live-weight of the cows was practically the same for each group.

The three experiments thus gave quite concordant results and bear out the general conclusion of the previously described large-scale experiments in showing an increased fat-content of the milk during the palm-kernel cake periods. The results would have carried more weight, however, if the yield and fat-content of the milk had been determined more frequently during each period.

Passing reference may be made to an experiment by Voltz[21] in 1913-14 with 4 cows, which gave results indicating a marked specific influence of palm-kernel cake on the secretion of milk-fat.

There remains to be noted a prolonged experiment, or rather a series of experiments, carried out by Hansen[1] in 1912, covering practically the whole year. These experiments were designed to test the effect on milk secretion on the one hand of the amount of palm-kernel cake fed and, on the other hand, of the oil-content of the cake. For the latter purpose cakes containing 5·45 per cent. oil and 12·42 per cent. oil, respectively, were used. The cakes were carefully stored in well-ventilated heaps and kept

quite satisfactorily throughout the year. In all, 33 cows were used, the numbers in the individual tests varying from 7 to 19 cows, the period system being used throughout. The cows were kept indoors for the whole time, and received along with the cake a basal ration of hay and roots (or dried sugar-beet slices). Throughout the tests the palm-kernel cake was compared against a mixture of maize and wheat bran, with a little ground-nut or soya cake to ensure equality of protein-content and starch equivalent. The periods mostly extended over 14 days, of which the latter half ranked as the experimental period proper. In a few cases this experimental period was extended to 14 days and in one case to 21 days. The amounts of palm-kernel cake fed ranged from 1 lb. to 6 lb. per 1,000 lb. live-weight.

The essential features of the results are summarised below, the average for the maize-bran ration being in each case taken as 100:—

Yield of Milk

Weight of Palm Kernel Cake fed per 1,000 lb. live weight. *lb.*	*Palm Kernel Cake poor in oil.*	*Palm Kernel Cake rich in oil.*
1·0	100·0	100·2
2·0	99·9	99·4
2·5	101·0	—
3·0	99·3	101·0
6·0	98·9	—

Percentage of Fat.

	Relative.	*Absolute Increase.*	*Relative.*	*Absolute Increase.*
1·0	103·2	+ 0·09	103·7	+ 0·11
2·0	103·0	+ 0·08	106·0	+ 0·19
2·5	104·0	+ 0·12	—	—
3·0	105·2	+ 0·16	107·3	+ 0·23
6·0	116·0	+ 0·45	—	—

Yield of Fat.

		lb.		*lb.*
1·0	102·5	·028	104·1	·048
2·0	102·9	·033	105·4	·070
2·5	105·2	·057	—	—
3·0	104·6	·055	108·6	·090
6·0	115·1	·172	—	—

In 76 records of individual cows only four failed to show the specific response to the cake poor in oil, whilst in 48 similar records from the tests with cake rich in oil only one negative result was obtained.

These results fully bear out the conclusions drawn from the earlier experiments, that palm-kernel cake, whilst having no appreciable influence upon the yield of milk, does sensibly increase the percentage of fat and, consequently, also the total output of fat in the milk. They furnish further evidence also that this specific influence of the palm-kernel cake is dependent, on the

hand, on its richness in oil. They indicate that if cake rich in oil be used a supply of 2 lb. per 1,000 lb. live-weight is sufficient to produce a measurable response in fat-secretion, whilst if cake poor in oil be used the necessary minimum is ½ lb. to 1 lb. higher. These conclusions, if correct, will account for many of the inconsistencies of earlier experiments. Throughout all the experiments the individuality of the cow has shown up prominently as a fundamental factor in determining the magnitude of the response to the specific stimulus of the palm-kernel cake.

In conclusion, reference may be made to evidence from dairy practice, to which attention is directed by Hansen. On examination of the records of the milk-record societies of the East Prussian Dutch Herd Book Association for the year 1911 it was found that in all herds with an average fat-content of over 3·4 per cent palm-kernel cake had been freely used, whilst in those herds whose milk showed an average fat-content of less than 3 per cent., in no single case had any appreciable quantity of this cake been used.[22]

British Experiments.—A few experiments with palm-kernel cake fed to dairy cows have been carried out in this country during the past two years, but they furnish only meagre and indecisive evidence on the point here under consideration.

In a comparison with decorticated cotton cake, made in the autumn of 1914 at the Lancashire County Council's farm at Hutton, using two groups of 6 cows each, Milburn,[23] found no appreciable difference between the effects of the two foods on either the yield of milk or its fat-content, despite the fact that an appreciably greater amount of palm-kernel cake than of cotton cake was fed. Against this must be set the fact that the cotton cake was extraordinarily rich in oil (17 per cent.) and, moreover, supplied more protein.

In a comparison of equal weights (6 lb.) of palm-kernel cake and Bombay cotton cake, made during the same winter, with two lots of 5 cows each at the Armstrong College Dairy Experimental Station (Offerton Hall),[24] the cows receiving palm-kernel cake gave, in each of the two periods of the experiment, the higher average percentage of fat in the milk, the difference in the first period being as much as 0·37 per cent.

It is clear from the report, however, that the experiment did not proceed smoothly, and that the averages are seriously affected by the disturbing factor of individuality.

In the spring of 1915 the writer conducted a small-scale experiment with two groups of four cows each at the Manor Farm, Garforth. With these groups, equal weights (2-4 lb.) of palm-kernel cake and Egyptian cotton cake were compared for

3 weeks after a preliminary period of 3 weeks in which both groups were fed alike. The results showed an apparent slight superiority of the palm-kernel cake with regard to milk-yield, but in the case of the percentages and total yield of fat the differences recorded were so small as to be within the range of probable error of experiment.

It is thus, at the present moment, impossible to form a definite opinion as to the probability of the conclusions arrived at from the best of the Continental experiments being directly applicable to the conditions of British dairy farming. The matter is one that requires to be further investigated, since it is unsafe to apply these conclusions directly, in view of the wide differences in breed of cows and general herd management in the two cases.

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COST OF SUMMER FEEDING IN MILK PRODUCTION.

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IN the December, 1915, number of this *Journal* (Vol. XXII., No. 9) there appeared an article on the cost of winter feeding in milk production based on actual figures collected for three years by Wye College from representative dairy farms in Kent and Surrey. A milk recorder visited 20 farms, averaging 32 cows apiece, regularly once a month, winter and summer, weighing the milk of the individual cows on the evening and morning of his visit and the amount of food fed to the milking herd, and at the same time checking the milk records kept by the farmers who undertook to weigh the milk themselves one day a week so as to increase the accuracy of the figures.

TABLE I.

Average Daily Cost of Indoor Feeding, Month by Month.

—	Cost of Food per Cow per day.			Average 1912–14.			
	1912.	1913.	1914.	Daily yield per Cow	Cost of Food per Cow per day.	Cost of Food per gal.	Average Percentage of Fat.
	d.	*d.*	*d.*	gal.	*d.*	*d.*	
January ..	16·10	13·29	12·10	2·15	**13·83**	6·43	3·7
February ..	15·74	13·40	12·87	2·23	**14·00**	6·28	3·6
March ..	15·37	13·33	12·75	2·26	**13·82**	6·12	3·6
April	7·49	12·12	13·10	2·34	**10·90**	4·66	3·6
May	3·02	3·22	5·20	2·56	**3·81**	1·49	3·6
June	1·90	1·45	1·62	2·38	**1·66**	·70	3·5
July	1·95	1·46	2·75	2·22	**2·05**	·92	3·6
August ..	2·34	1·75	3·28	2·19	**2·46**	1·12	3·7
September ..	2·73	2·54	4·96	2·12	**3·41**	1·61	3·7
October ..	4·09	3·75	8·86	2·11	**5·57**	2·64	3·8
November ..	11·76	8·97	11·55	2·10	**10·76**	5·12	3·7
December ..	12·70	11·12	12·27	2·16	**12·03**	5·57	3·7

As was stated in the article referred to, considerable difficulty is experienced in separating the year into two distinct periods, winter and summer, although it is desirable that this should be done. There is no well-defined line of demarcation either in the spring or in the autumn between the dates when the cows are taken off their winter ration and go to grass in the spring, or vice versa in the autumn. The date varies not only on the individual farms, but in different years according to the earliness or lateness of the season. In the autumn there is a special difficulty because there is often quite a long intermediate period

during which the cows are still benefiting from the grass and yet are receiving a large proportion of their winter ration. In a dry autumn, when the grass gets parched up and scorched, the cows get on to their winter ration early; on the other hand, in a wet, mild autumn, the allowance of roots and fodder can sometimes be kept very low well into December. The above table (Table I.), showing the cost of indoor feeding only, month by month—grazing is excluded, as it is impossible to apportion the cost of this over the different months of the summer —brings out this point very clearly.

After careful consideration of these figures, year by year and farm by farm, it was decided to take the winter period as lasting for 6 months (1st November to 30th April) and the summer period for the other 6 months (1st May to 31st October), and the same division has been taken every year so as to make the results of the different years comparable.

In estimating the cost of the summer feeding the value of the grazing has been taken as nearly as possible at the actual cost to the farmer on each individual farm. The rental of the farm, as a whole, has been taken and the value of the particular fields in question calculated according as to whether the quality of the land varied above or below the average of the farm. In cases where the cows only grazed the aftermath, the value of the field was first considered, and from 15 to 20 per cent. of this (according to the ideas of the particular farmer) was taken as the value of the aftermath, the rest of the value being considered to be apportioned to the hay crop. The figures may be considered to err somewhat on the low side, as it was impossible to come to any agreement as to the charges to be made for hedging, ditching and manures.

As regards the soiling crops it was originally intended to take these at the actual cost of production on the different farms, but considerable difficulty was experienced owing to crop failures, assessment of the value of manures used, etc., so that finally the same cost per acre was used on every farm. The costs per acre for cultivation, manures, seed, cutting and carting, rent, etc., were taken as follows for the different crops:—

	£	s.	d.	
Maize	6	6	0	per acre.
Tares	5	5	0	,,
Rye	4	12	0	,,
Lucerne	3	5	0	,,
Trifolium	2	6	0	,,

These figures for the soiling crops have been applied to all farms alike where the crops were grown.

Purchased foods were charged at cost price plus a small allowance for cartage, and hay, straw, mangolds, and turnips were charged at 60*s*., 40*s*., 10*s*., and 8*s*. per ton, respectively, as explained in the December number of the *Journal*.

The three summers under consideration are those of 1912, 1913 and 1914, and the War has had no influence on the figures, as prices of feeding-stuffs did not rise to any extent until the winter of 1914-15. With the present increased prices of labour, manures and feeding-stuffs the figures quoted in this article are, of course, too low, and allowance must be made accordingly; but, in spite of this, the lessons to be learnt from them remain the same.

A striking characteristic of the 3 years' figures has been the great variation in the cost of feeding on the different farms. Table II. gives the figures for the 2 farms that produced milk at the lowest and highest cost respectively for food per gallon of milk in each summer.

TABLE II.

Details of the Cheapest and the most Expensive Milk-producing Herds.

Herd.	No. of Cows in Milk.	Daily Yield per Cow	Cost of Food per Cow per day.	Cost of Food per gal. of Milk.	Analysis of Cost per gal.		
					Pasture and Aftermath.	Soiling Crops.	Indoor Feeding
Summer, 1912.		gal.	*d.*	*d.*	*d.*	*d.*	*d.*
D ..	22	2·14	2·46	**1·15**	·87	—	·28
T ..	8	2·21	9·61	**4·35**	1·05	·18	3·12
Summer, 1913.							
O ..	22	2·19	2·82	**1·29**	1·02	·05	·22
AE ..	23	2·44	8·96	**3·67**	1·86	·08	1·73
Summer, 1914.							
I ..	25	1·84	3·97	**2·16**	·86	—	1·30
BE ..	19	1·77	12·06	**6·82**	2·25	—	4·57

In each year it will be seen that milk cost three times as much in food on one farm as on another and a study of the complete figures for the whole series of farms* shows very wide variations in the costs and the yields of milk in the different herds. The greatest extremes were found in the summer of 1914 when Herd I produced milk at 2·16*d*. per gal. for food, whilst Herd BE produced it at 6·82*d*. per gal. which was more

* See the Second, Third and Fourth Reports on the "Cost of Food in the Production of Milk." Issued by the S. E. Agric. College, Wye.

than the milk was costing (for food) during the following winter in the case of the great majority of the farms.

It may be of interest to study the cause of these extremes in the cost of the summer feeding. The cheapest feeding during the 3 years was on Farm D in the summer of 1912, and the details of the feeding of this herd are shown in Table III.

TABLE III.

Details of the Feeding of Herd D. Summer, 1912.

Month.	Average No. of Cows in Milk.	Daily Yield per Cow.	Egyptian Cotton Cake.
		gal.	lb.
May	22	2·41	807
June	19	2·58	—
July	21	2·29	—
August	24	1·79	—
September	23	2·22	840
October	24	2·00	2,072

	£ s. d.
Total—1 ton 13 cwt. 23 lb. Egyptian cotton cake at £6 per ton	9 19 3
25½ acres pasture at 22*s.* 6*d.* per acre	28 13 9
21 acres aftermath at 3*s.* per acre	3 3 0
Total cost of feeding	£41 16 0
Returns of milk	8,745 gal.
Cost of food per gal. of milk ..	1·15*d.*

The low cost of summer feeding was thus due to the possession of fairly cheap pastures which, by reason of the quantity and quality of the grass they produced, did not require to be supplemented by soiling crops or by the purchase of large quantities of concentrated foods.

The case of Herd O in the summer of 1913 is very similar, the details of the feeding being as shown in Table IV.

TABLE IV.

Details of the Feeding of Herd O. Summer, 1913.

Month.	Average No. of Cows in Milk.	Daily Yield per Cow.	Egyptian Cotton Cake.	Linseed Cake.
		gal.	lb.	lb.
May	26	2·68	—	—
June	25	2·38	—	—
July	22	1·87	—	—
August	19	2·09	—	—
September ..	18	1·95	630	180
October ..	22	2·26	1,500	480

	£	s.	d.
Total—19 cwt. 2 lb. Egyptian cotton cake at £6 5s. 0d. per ton	5	18	10
5 cwt. 100 lb. linseed cake at £8 per ton ..	2	7	2
46½ acres pasture at 15s. per acre	34	17	6
22½ acres aftermath at 2s. 3d. per acre	2	10	7
4 acres second-cut seeds at 10s. 3d. per acre ..	2	1	0
Total cost of feeding	£47	15	1
Returns of milk	8,862 gal.		
Cost of food per gal. of milk ..			1·29d.

In this case the run of a large area of cheap grass (2 acres of pasture and 1 acre of aftermath per cow) which was able to keep the cows in condition with very little assistance was the chief cause of cheap milk production.

The same reason applies to Herd I in the summer of 1914. The milk yield was very low (1·84 gal. per cow per day), but the cost of feeding was more than 1*d*. per cow per day less than on any other farm in that year, mainly on account of the very cheap grass (costing 1·59*d*. per cow per day). The 25 cows grazed 42 acres of pasture valued at only 12*s*. 6*d*. per acre and 36 acres of aftermath valued at 2*s*. 6*d*. per acre, and no soiling crops at all were fed throughout the summer. The cakes and meals were somewhat limited in quantity, the cows receiving 5¾ cwt. apiece during the 6 months, *i.e.*, at the rate of 3½ lb. per head per day; 3 lb. Bombay cotton cake per head per day were fed all through the summer, the rest of the concentrated food being mainly linseed cake.

Turning now to the causes of high cost of production, the examples of Herds T, AE and BE in the summers of 1912, 1913 and 1914 show that this is due mainly to expensive indoor feeding. The details of the feeding of Herd T in the summer of 1912 are shown in Table V.

TABLE V.

Details of the Feeding of Herd T. Summer, 1912.

Month.	No. of Cows in Milk.	Daily Yield per Cow.	Dry Fodder.	Wet Grains.	Cakes and Meals.	Cabbages
		gal.	lb.	lb.	lb.	lb.
May	9	2·33	—	5,040	693	—
June	9	2·00	2,576	5,040	1,120	—
July	7	2·50	607	3,920	1,120	—
August ..	8	2·25	1,792	3,920	1,568	—
September ..	8	2·25	784	3,920	1,568	—
October ..	8	2·25	1,378	5,424	1,567	6,720

	£	s.	d.
Total—12 tons 3 cwt. 48 lb. wet grains at 16s. 6d. per ton	10	0	10
3 tons 8 cwt. 20 lb. cakes and meals at 140s. per ton	23	7	3
1 ton 8 cwt. 102 lb. hay at 60s. per ton ..	4	6	9
1 ton 14 cwt. 91 lb. straw at 40s. per ton ..	3	9	7
3 tons 0 cwt. 0 lb. cabbages at 10s. per ton	1	10	0
14 acres pasture at 20s. per acre..	14	0	0
3 acres aftermath at 3s. per acre		9	0
½ acre lucerne (3 cuts)	2	10	0
Total cost of feeding	£60	3	5
Returns of milk	3.315 gal.		
Cost of food per gal. of milk ..	4·35*d.*		

This farm suffered very severely all the summer through the lack of good pasture, and consequently dry fodder, cakes and meals had to be largely used, with the result that the cost of food per cow per day was nearly as high as during the winter period. The cost of feeding during the following winter was, as a matter of fact, comparatively low (12·00*d.* per day), and as the daily yield of milk was higher in the winter than in the summer the cost of food per gal. of milk was practically the same in the two periods, viz., 4·50*d.* per gal. in the winter and 4·35*d.* per gal. in the summer.

It is unfair to criticise the feeding of Herd AE in the summer of 1913, because the farm is situated close to a town and the milk is retailed. Every endeavour has to be made to keep the yield of milk up to a definite fixed quantity all the year round; consequently, when the grass was getting parched in the middle of the summer, very heavy indoor feeding had to be resorted to in order to keep the yield of milk up to the high average of 2·44 gal. per cow per day. The 23 cows had the run of 23 acres of pasture which, being close to the town, was valued at £2 per acre, though its value solely as a pasture was considerably less; 36 acres of aftermath and half an acre of maize were also fed to the cows. More than £73 worth of manger food, costing alone more than 4*d.* per head per day, was consumed during the summer.

The details of the feeding of Herd BE in the summer of 1914 are shown in Table VI. This herd did not come into the scheme until the month of June, so that the figures for May are an estimation only, having been taken to be the same as for June.

In this case the yield of milk was very low (1·77 gal. per head per day), and the cost of feeding excessively high (12·06*d.* per cow per day). Most of the herds produced their winter milk more cheaply than that, and this particular herd produced milk during the following six winter months at 7·11*d.* per gal., less than ½*d.* more per gal. of milk. The cost of the grass was

TABLE VI.

Details of the Feeding of Herd BE. Summer, 1914.

Month.	No. of Cows in Milk.	Daily Yield per Cow.	Dry Fodder.	Wet Grains.	Man-golds.	Cakes and Meals.
		gal.	lb.	lb.	lb.	lb.
May	17	2·29	6,200	—	17,980	3,162
June	17	2·29	6,000	—	17,400	3,060
July	21	2·13	—	—	—	5,580
August.. ..	18	1·87	—	—	—	6,107
September ..	20	1·17	420	7,560	—	6,720
October ..	18	1·21	8,928	1,953	—	4,991

	£	s.	d.
Total—15 tons 15 cwt. 100 lb. mangolds at 10s. per ton	7	17	11
7 tons 17 cwt. 0 lb. hay at 60s. per ton ..	23	11	0
1 ton 15 cwt. 44 lb. straw at 40s. per ton ..	3	10	9
4 tons 4 cwt. 105 lb. wet grains at 27s. per ton	5	14	8
13 tons 4 cwt. 52 lb. cakes and meals at 112s. per ton..	74	1	0
34 acres pasture at 22s. 6d. per acre	38	5	0
32 acres aftermath at 8s. 6d. per acre	13	12	0
20 acres aftermath at 4s. 6d. per acre	4	10	0
Total cost of feeding	£171	2	4
Returns of milk	6,018 gal.		
Cost of food per gall. of milk ..	6·82*d*.		

high (2·25*d*. per gal.), and the cost of indoor feeding (4·57*d*. per gal.) was far too heavy. The cakes and meals averaged 8·7 lb. per head per day, costing 5·22*d*. all through the summer, exclusive of the wet grains and some mangolds and hay. Even if the cows had averaged 3 gal. of milk a day, instead of less than 2 gal., the cost per gal. of milk would have been above the average.

So far we have only dealt with the cost of feeding on individual farms, and it would not be wise to draw far-reaching conclusions from these, as conditions were exceptional. A better method is to divide all the herds under observation during the different seasons into 3 groups—the cheap milk producers, the expensive milk producers, and the intermediates—and then by comparing the 3 groups with one another a reliable basis for comparison is obtainable. The herds are set out in this way in Table VII.

It will be noticed that there is little difference between the milk yields of the different groups and that it is the cost of feeding, and especially the cost of indoor feeding, that has most influenced the cost per gal. of milk. The cost of feeding depends primarily on the grass. If the grass is adequate, and supplies all the needs of the cows, no soiling crops and little indoor feeding will be necessary, but Table VII. shows that the expen-

sive herds, giving approximately the same amount of milk as the cheap herds, cost 3·64*d*. per day more for food, the extra cost being distributed amongst the pasture and aftermath (1·00*d*.), soiling crops (0·41*d*.) and manger feeding (2·23*d*.). Evidently, therefore, on the expensive farms either the grass, although it cost more, was not adequate and had to be supplemented, or else the cows were being overfed. A large area of good grass which will not dry up in a hot summer is evidently a very important factor in the economical production of summer milk. With this as a foundation, very little green soiling will be necessary, and the feeding of cakes and meals can be much reduced. The fact that the cheap herds, with grass costing only 2·41*d*. per day and manger foods 2·08*d*. per day, have produced their milk at little more than half the cost of the expensive herds, with grass costing 3·41*d*. per day and manger foods 4·31*d*. per day, brings this point out very clearly.

TABLE VII.

Comparison of Summer Costs.

——	Daily Yield per Cow	Cost of Food per Cow per day.	Cost of Food per gal. of Milk.	Analysis of Daily Cost.		
				Pasture and After-math.	Soiling Crops.	Indoor Feeding
	gal.	*d.*	*d.*	*d.*	*d.*	*d.*
20 Farms, Summer, 1912—						
7 Cheap Herds ..	2·24	3·87	**1·73**	2·48	·08	1·31
6 Intermediate ..	2·18	5·25	**2·41**	2·52	·47	2·26
7 Expensive Herds ..	2·26	7·93	**3·51**	3·09	·56	4·28
Average ..	*2·29*	*5·71*	**2·49**	*2·70*	*·37*	*2·64*
17 Farms, Summer, 1913—						
6 Cheap Herds ..	2·21	3·84	**1·74**	2·23	·19	1·42
5 Intermediate ..	2·34	5·31	**2·27**	2·81	·27	2·23
6 Expensive Herds ..	2·35	7·24	**3·08**	2·82	·29	4·13
Average ..	*2·30*	*5·47*	**2·38**	*2·61*	*·25*	*2·62*
20 Farms, Summer, 1914—						
7 Cheap Herds ..	2·19	6·11	**2·79**	2·50	·21	3·40
6 Intermediate ..	2·22	8·06	**3·63**	3·09	·44	4·53
7 Expensive Herds ..	2·09	9·55	**4·57**	4·24	·83	4·48
Average ..	*2·16*	*7·90*	**3·66**	*3·29*	*·49*	*4·12*
Average of 3 Summers—						
20 Cheap Herds ..	**2·21**	**4·65**	**2·09**	**2·41**	**·16**	**2·08**
17 Intermediate ..	**2·24**	**6·25**	**2·77**	**2·80**	**·40**	**3·05**
20 Expensive Herds	**2·23**	**8·29**	**3·74**	**3·41**	**·57**	**4·31**
Average ..	**2·23**	**6·41**	**2·87**	**2·88**	**·38**	**3·15**

It should be noted that the summer of 1914 was very dry, with the result that the grass gave out and expensive indoor feeding had to be indulged in. A larger acreage of grass had to be allowed to the cows (2·70 acres instead of 2·30 acres), green

soiling was resorted to more freely and more cakes and meals were fed. In spite of this extra feeding the average yield of milk was less than in 1913 (2·16 gal. per day instead of 2·30 gal.), so that the cost of feeding per gal. was considerably higher, the milk costing half as much again in 1914 as in either 1913 or 1912. Many of the herds were, in fact, on a winter ration by October. Table I. shows this very clearly, the cows costing 8·86*d.* per day for manger food in October, 1914, as compared with 3·75*d.* in October, 1913, and 4·09*d.* in October, 1912. There was very little variation in the cost of purchased feeding-stuffs in the 3 years, prices in 1914 being practically the same as in 1913, and about 5*s.* per ton higher than in 1912. The extra cost was the result solely of a shortage of grass.

No farmer can suddenly increase the amount of grazing he allows to his cows above a certain limit. In extreme cases he gives the cows the run of a grass field he originally intended for hay, but if he does that he runs a serious risk of being short of fodder in the following winter. For that reason the acreage of grass per cow has not varied very much from year to year (see Table VIII.).

TABLE VIII.

Area and Cost of Grazing and Green Soiling per Cow.

	£ s. d.	£ s. d.
1912—1·34 acres pasture at 24*s.* 9*d.* per acre ..	1 13 2	
1·19 acres aftermath at 4*s.* 4*d.* per acre ..	5 2	
0·12 acres soiling crops at 61*s.* 6*d.* per acre	6 2	
		2 4 6
1913—1·23 acres pasture at 25*s.* 4*d.* per acre ..	1 11 2	
1·07 acres aftermath at 4*s.* 10*d.* per acre ..	5 2	
0·06 acres soiling crops at 63*s.* per acre ..	3 9	
		2 0 1
1914—1·65 acres pasture at 24*s.* 6*d.* per acre ..	2 0 5	
1·03 acres aftermath at 5*s.* 4*d.* per acre ..	5 6	
0·11 acres soiling crops at 57*s.* 6*d.* per acre	6 4	
		2 12 3

In a dry summer a farmer has to increase his indoor feeding, and that is what had to be done in the summer of 1914. The cost of manger foods in the summer of 1914 was half as much again as in 1913 (Table IX.), and yet the yield of milk was lower (2·16 gal. instead of 2·30 gal.).

In 1914 the cakes and meals were responsible for 43 per cent. of the whole cost of feeding, as compared with only 30 per cent. in 1912. Nor does the expense due to a dry summer end here. Besides increasing the cost of summer feeding by from 2½*d.* to 3*d.* per cow per day (1*d.* to 1½*d.* per gal. of milk), a dry summer has a considerable effect on the cost of winter feeding as well by reducing the size, and consequently increasing the cost per ton, of the root, hay and straw crops. A poor crop of

TABLE IX.

Average Cost of Indoor Feeding per Cow.

	£	s.	d.	£	s.	a,
1912—9·82 cwt. roots at 10s. 2d. per ton		5	0			
0·57 cwt. fodder at 55s. 4d. per ton ..		1	7			
10·10 cwt. wet grains at 17s. 10d. per ton ..		9	0			
3·94 cwt. cakes and meals at 128s. 8d. per ton	1	5	4			
				2	0	11
1913—8·80 cwt. roots at 9s. 11d. per ton		4	4			
0·76 cwt. fodder at 54s. 8d. per ton ..		2	1			
3·62 cwt. wet grains at 18s. per ton ..		3	3			
5·10 cwt. cakes and meals at 124s. per ton	1	11	7			
				2	1	3
1914—11·39 cwt. roots at 10s. 6d. per ton ..		6	0			
2·15 cwt. fodder at 54s. 8d. per ton ..		5	11			
0·10 cwt. wet grains at 18s. 6d. per ton ..			1			
7·97 cwt. cakes and meals at 124s. per ton	2	9	5			
				3	1	5

roots costs very nearly, if not quite, as much to grow as a good crop, and £10 laid out in an acre of swedes may produce 30 tons (6s. 8d. per ton) in a favourable season or 15 tons (13s. 4d. per ton) in a dry season. By referring to the article in the December, 1915, number of the *Journal*, p. 847, it will be seen that a cow consumes roughly 4 tons of roots and 21 cwt. of fodder in the winter 6 months, and that *half* a crop of roots and half a crop of hay and straw will increase the cost of winter feeding by about £4 10s. per head (6d. per day or 2¾d. per gal. of milk). A droughty summer is, therefore, very serious to the dairy farmer in the following winter as well as in the immediate summer. The effect of a really dry summer is, in fact, far more serious than a large increase in the price of purchased feeding-stuffs. It was shown in the article referred to that a cow consumes about 12 cwt. of cakes and meals during the winter 6 months, costing about £4 (5·33d. per day or 2·46d. per gal.), so that a rise of 70 per cent. in the price of purchased feeding-stuffs increases the cost of winter feeding by only £2 16s. (3·73d. per day or 1·72d. per gal. of milk). The effect of this rise in the price of feeding-stuffs on the cost of summer feeding is less because a smaller quantity of purchased foods is fed in the summer months.

A summary of the 3 years' figures for 1,942 cows, showing the average quantity of food fed per cow during the 6 summer months and the cost of feeding, is given in Table X.

It will be seen that only about 5½ cwt. of cakes and meals are usually fed per head in the summer, costing, roughly, £1 15s. (2·33d. per day or 1·04d. per gal.), so that the effect of a rise of 70 per cent. in the cost of these foods is to raise the cost of summer feeding by £1 4s. 6d. per head (1·63d. per day or 0·73d. per gal.). We have already seen that a dry summer may increase the cost of summer feeding by from 2¼d. to 3d. per day and winter feeding by 6d. per day, so that the present

TABLE X.

Summer Requirements of an Average Cow.

	£	s.	d.	
1·41 acres pasture at 24s. 10d. per acre ..	1	14	11	(37 per cent.)
1·10 acres aftermath at 4s. 10d. per acre ..		5	3	(6 ,,)
0·09 acres soiling crops at 60s. 8d. per acre ..		5	5	(6 ,,)
10·00 cwt. roots at 10s. 2d. per ton		5	1	(6 ,,)
1·16 cwt. fodder at 54s. 11d. per ton ..		3	2	(3 ,,)
4·61 cwt. wet grains at 18s. 1d. per ton ..		4	1	(4 ,,)
5·67 cwt. cakes and meals at 125s. 7d. per ton	1	15	5	(38 ,,)
Total Cost ..	£4	13	4	

Average cost per day £4 13s. 4d. ÷ 180 = 6·22d.
Average daily yield of milk, 2·23 gal.
Average cost of food per gal. of milk, 2·79d.

high price of feeding-stuffs, if it was the sole effect of the War on dairy farming, would not be so serious as is sometimes thought, and the farmer could recompense himself for it by charging an extra ¾d. per gal. for his milk in the summer and an extra 1¾d. per gal. for his winter milk. Unfortunately, however, that is not the only way in which the War has affected dairy farming. The scarcity and high price of labour, both for the actual management of the cows and for the general working of the farm, the increased cost of growing the home-grown foods on account of the prices of labour and manures, the high price of cows—all these are the direct results of the War and are the chief causes of anxiety to the dairy farmer.

As has been already stated, the figures quoted in this article must not be accepted as applicable at the present time, because roots, hay and straw cannot now be grown at the same cost as they could before the War and purchased foods have increased by from 65 to 70 per cent. in cost. This, however, does not affect the value of the tables that have been given and analysed. The lessons to be drawn from them still remain the same. Some farmers can feed their cows very much more cheaply than others. This is due in some cases to causes outside the control of the farmer and to the great variation in local conditions. As has already been pointed out, it is unfair to compare a farmer who is paying a high rent because he is situated near a large town with another farmer whose land is equally as good, but whose rent is less because he is farther away from a market. The cost of summer feeding is very largely influenced by the rent of the grass land, and rents vary widely according to the district as well as according to the fertility of the land. Heavy manger feeding is usually connected with expensive feeding; and a large area of good grass which will carry the cows through a dry season without much help is invaluable to the dairy farmer.

Cheap cost of production seems to be bound up more with cheap feeding than with heavy milk yields, though, of course, the farmer who arranges for the majority of his cows to calve in the spring will produce his summer milk more cheaply than the farmer who arranges for most of his cows to calve in the autumn. In the winter season, however, the opposite will be the effect and statistics show that cows that calve in the autumn produce, on the whole, a larger quantity of milk during the lactation period than cows that calve in the spring. The farmer who keeps a good herd of heavy-milking cows, which give a liberal supply of milk on ordinary feeding will, of course, always have the advantage over the farmer with an indifferent herd that either gives a small supply of milk or only milks well when heavily fed. To what extent it pays to feed concentrated foods to cows on grass depends on the circumstances of each case. If there is sufficient grass to supply the full needs of every cow the feeding of cake will obviously be wasteful, but in most cases, after the first flush of grass is over, newly-calved cows will require extra feeding if they are to be kept up in condition and their milk yield maintained. It is impossible to lay down standards as for winter feeding, but the general principle that cows should be fed according to the amount of milk they give still holds good. The cows should not all be fed alike. Those giving most milk should have the best pasture and the most concentrated food, and a common practice is to feed concentrated food only to those cows giving more than a certain quantity of milk and to feed these at the rate of 2 to 3 lb. per gal. of milk above that standard. Cows giving less than that quantity of milk, it may be 2, 2½ or 3 gal. according to circumstances, receive no more than the grass they can forage for themselves or a little green meat besides.

What affects the cost of summer feeding more than anything else, however, is the season. A late spring will increase the cost of feeding in May. A dry summer will reduce the supply of grass without reducing the cost and will necessitate heavy indoor feeding. In the autumn the cows may have to be back on their winter ration by the beginning of October if there is no grass. A dry summer may easily increase the cost of summer milk production by 1½*d*. per gal. and winter milk production by 2½*d*. to 3*d*. per gal. On the other hand, a rise of even 100 per cent. in the cost of purchased feeding-stuffs would not increase the cost of summer feeding by more than 1*d*. per gal. or winter feeding by more than 2½*d*. per gal. There is usually a difference of about 2¾*d*. per gal. (6¼*d*. per day) between the cost of

A PRELIMINARY ENQUIRY INTO THE COST OF PRODUCTION OF SILAGE IN EAST ANGLIA.

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DURING the series of wet years which followed 1879, a great effort was made by several prominent agriculturists to introduce the system of ensilage into English farming practice. These gentlemen were successful in creating a very lively enthusiasm for the system, numerous silos of varying design and structure were erected in many counties, experiments were carried out by the Royal Agricultural Society, Lawes and Gilbert, and others, and much silage was made, not only in the silos, but also in silage stacks and in pits. In 1885-6 the Ensilage Commission met, and after examining a large number of witnesses, all of whom, with the notable exception of the late Sir John Lawes, gave favourable evidence, issued a lukewarm report in favour of the practice. With an improvement in the seasons, interest in the subject gradually diminished, and since 1900 very little silage has been made in England.

It should be noted that in the past the crops used for making silage were chiefly grass or clover, crops which are normally not especially bulky and which in good seasons can be easily made into hay and fodder at less cost than into silage. With the one exception of maize, which crop has hitherto only been grown extensively in the southern and eastern parts of England, little effort seems to have been made to grow special bulky crops for silage.

In 1901 fresh interest was aroused in the subject by Mr. F. B. Smith, late of Wye College, who, after a visit to some of the American colleges, where maize silage is so closely associated with winter stock-feeding, discussed the subject in the report* of his visit. As a result of this report a series of experiments were carried out at Wye College† to test the economy of maize silage. These experiments showed that maize silage as made at Wye was not profitable, because, although the maize was grown upon early soil and early varieties were planted, it contained, when

* "Agriculture in the New World."—F. B. Smith.
† Journal South Eastern Agricultural College, 1901–1904.

cut, a much greater percentage of moisture than American-grown maize. The result of this was that owing to losses during fermentation as much as 36 per cent.* of the total dry material disappeared.

During the last few years, and largely owing to the enthusiasm of Mr. G. Jaques, a number of silos have been erected in East Anglia, and increased interest is being taken in the subject.

The Silo.—The modern silo is 30 ft. or more in height, whereas the silos in 1880 varied from 15 to 20 ft. The advantage of the increased height is that it produces a great automatic pressure on all but the top layers of silage and thus obviates the necessity of weighting down the silage, a process which was so troublesome a feature of the earlier silos.

Two types of silo have recently been erected in East Anglia: (*a*) the wooden stave silo of the American pattern, and (*b*) the concrete cylindrical silo similar to the American reinforced concrete silo.

In America, where wood is cheaper than concrete, the majority of silos are constructed of wood; but in England, where wood is more expensive, the greater durability of concrete is worthy of consideration.

The Silage Crop.—The crop chiefly grown for ensilage consists of tares, to which is added a sufficient quantity of oats (or rye on light land) to keep the tares off the ground. This mixture produces a bulky crop, difficult to make into good hay, but excellent for silage.

Cleaning.—The crop is grown on part of the fallow break. It enables the land in most cases to be cheaply cleaned because the tares and oats, being autumn sown and a smother crop, keep the weeds in check till the crop is cut in June or early July; then the land can be broken up and the cleaning completed by a bastard fallow.

If the land is perfectly clean it is sometimes possible to take a catch crop after the silage crop is harvested, but it is important to point out that the oat and tare crop does not kill weeds (as claimed by some authorities), and if the object is to clean the land the catch crop should not be attempted.

Manuring.—Being a leguminous crop, tares can obtain a large proportion of their nitrogenous plant food from the air by means of their root nodules, and they require little or no nitrogenous manure. A liberal supply of a phosphatic manure with, in some cases, potash, provides a cheap and sufficient manuring

* Journal of Agricultural Science, Vol. 2, *Composition of Maize Silage*.—H. E. Annett and E. J. Russell.

on soils containing a moderate amount of humus. By accumulating nitrogen the tare crop increases the stock of this manurial ingredient upon the farm.

Certainty of Crop.—Unlike the root crop, the oat and tare crop is an easy crop to grow; and, as far as our experience goes, complete failures are comparatively rare. Again, the crop, though preferably secured in fair weather, can be harvested quite well when the weather is showery.

Effect of Tares upon the Growth of Succeeding Leguminous Crops. In districts where leguminous crops are already grown very frequently there is the possibility that the introduction of tares into the root break may adversely affect succeeding leguminous crops. Thus, if tares are grown instead of mangolds, and are followed by a corn crop in which clover is sown, it is by no means certain that the clover would succeed so well after the tares as it would have done after mangolds. Further experience on this subject is required.

Investigations into Making of Silage.—In view of these new features of the practice, the writers have investigated some of the financial aspects of the problem, and they are especially indebted to Mr. J. T. Smith of West Barsham, Walsingham, Norfolk, and to Mr. Clement C. Smith, of Blofield Hall, Trimley, Suffolk, on whose farms most of the investigations were made, and whose assistance has been readily given on all occasions.

This problem has been investigated in four stages:—

The weight of crop produced per acre.

The cost of the silo and cutter.

The cost of producing the crop.

The cost of cutting the crop and filling the silo.

The Weight of Silage Crop Produced per Acre.—The table below (Table I.) gives the results of weighing the produce of four crops of oats and tares grown for ensilage in 1915. In each case the crops were weighed when being cut for the silo, care being taken that no dew or rain was on the foliage. The

TABLE I.

Field No.	Soil.	Manuring.	No. of Plots weighed.	Limits of Plot Variation (weight per acre).	Average Weight per acre.
				t. c. t. c.	*t. c.*
1	Sand ..	None ..	6	5 14 to 10 4	8 0
2	Sandy loam	10 loads dung	5	8 9 „ 13 6	10 15
3	Brickearth clay.	20 loads dung	7	8 0 „ 17 10	14 1
4	Gault clay ..	None ..	3	10 8 „ 10 18	10 13

crop was cut generally when the oats were in their milk stage and the seeds in the lowest pods on the tares were still soft, except in field No. 3, which was cut when the tares were in full flower. The dry matter was not determined in all cases, but in a few cases in which this was done it approximated to 30 per cent. of the total weight.

It was not possible to weigh the whole produce of the fields; the weight per acre was arrived at by weighing the produce on carefully measured small plots, selected at random in various parts of the field, and taking a mean of the figures so obtained. The authors do not claim that this method will have given very accurate results, because the number of such weighed plots was small, but it serves to give an approximation to the truth.

The weights obtained show that the unmanured sandy soil produced the smallest crop, only 8 tons per acre; this result was in accordance with expectations, for the crop always appeared thin and light. The crops on fields Nos. 2 and 4 were average in appearance, and in each case yielded nearly 11 tons per acre. The crop on field No. 3 was very good, although on one part of the field, owing to variation in the quality of the land, the crop was lighter than on the rest.

From these results it may be concluded that an average crop of oats and tares will vary from 10 to 12 tons per acre, and that well-manured crops on good land may produce as much as 14 to 15 tons per acre and, in exceptional cases, perhaps more.

Cost of Silo, Cutter and Blower.—The silos erected on both Messrs. J. T. Smith's and C. C. Smith's farms are 32 ft. high.

TABLE II.

	£	s.	d.
Cost of silo erected on site, April, 1915 = £130—*			
Annual depreciation (20 years)	6	10	0
5 per cent. interest on initial capital	6	10	0
Repairs	1	0	0
Cost of cutter assembled on farm, April, 1915 = £50.† (One cutter serves five silos.)			
One-fifth of annual depreciation (10 years) ..	1	0	0
One-fifth of 5 per cent. interest on initial capital ..		10	0
One-fifth of Repairs (estimated at 50*s.*)		10	0
	£16	0	0

Capacity of silo=130 *tons of silage*.††

Assuming a loss of 15 per cent. in storage, 153 tons of green crop produce 130 tons of silage.

The cost per ton of green crop filled to silo is, therefore=2*s.* 1*d.*§

* Cost of similar silo, April, 1914 = £100.

† Cost of similar cutter and blower, April, 1914 = £35.

†† Tables of capacities of silos. ("Modern Ensilage," by Silver Manufacturing Co., Salem, Ohio, U.S.A.) These figures are given in American tons of 2,000 lb. and apply to maize silage. We have adopted them for English tons of 2,240 lb. for oat and tare silage, since under English conditions the silo takes longer to fill and consequently the settling is greater.

§ With 1914 prices, cost per ton = 1*s.* 8*d.*

and 16 ft. in diameter; they are constructed of creosoted wood, and it is estimated that their probable life will be from 15 to 25 years. For the purpose of this article 20 years has been taken as an average.

A combined cutter and blower is used for chaffing and elevating the green crop to the top of the silo in one operation. One such cutter and blower will serve to fill five silos during the season and it is estimated that under these conditions the outfit may last for from 10 to 15 years; for the purpose of this article the former period has been taken.

From Table II. (p. 336) it is seen that prices both of the silo and the cutter had risen largely in 1915 owing to the war, the silo chiefly because of the increased cost of wood, and the cutter partly because of the cost of transport from America. It is to be hoped that cutters and elevators may soon be manufactured in England and thus save much loss of time and inconvenience when parts are broken.

Attention is also directed to the large amount, £7 10*s.*, charged to the two items depreciation and repairs. As previously stated, the life of a wooden stave silo has been variously estimated at from 15 to 25 years. There is no evidence upon this point in England, but it must largely depend upon the care bestowed upon it. Again, there is no information available in this country as to what will be the cost of repairs; during the earlier years this may not be great, but as the silo ages it may increase very largely. To some extent this will be balanced by the reduction in the charge for interest on capital as the capital is gradually written off.

If the soundness of the ensilage system is established in England, a careful examination of the cost and possibilities of the concrete silo should be made. It is true that in America these concrete silos are not so popular as wooden stave silos, partly because wood is so cheap and partly because, with severe frosts, the silage in a concrete silo is more quickly frozen and injured. In England wood is more expensive and frost less severe.

The Cost of Production of the Silage Crop.—The figures in Table III. (p. 338), which are based upon records kept by Messrs. J. T. Smith and C. C. Smith, show the cost of production of the silage crop on three fields in 1915.

It will be noticed that field No. 1 was a poor, sandy soil, field No. 2 a sandy loam, and field No. 3 a fairly stiff clay.

It was difficult to apportion rent and rates satisfactorily because in each case a second catch crop was taken after the tare crop was cut. In each case the whole rent has been charged

to the silage crop and no charge has been made for rates, which are regarded as being borne by the subsequent crop.

TABLE III.

	Field No. 1.	Field No. 2.	Field No. 3.
Type of soil.	Sand.	Sandy Loam.	Brickearth Clay.
	£ s. d.	£ s. d.	£ s. d.
Rent	15 0	1 0 0	1 5 0
Cost of cultivations	15 0	15 3	16 6
Cost of seed	12 6	12 9	18 0
Half cost of manure (and spreading)	Nil.	1 3 9	1 17 6
Total cost per acre	£2 2 6	£3 11 9	£4 17 0
	t. c.	t. c.	t. c.
Weight of green crop per acre ..	8 0	10 15	14 1
	s. d.	s. d.	s. d.
Cost per ton of green crop ..	5 4	6 8	6 11

Cost of Cultivation.—The cost of cultivation was arrived at by estimating the number of horses and men required for the cultivations in each field and charging each man-day (the work done by one man in a day) and each horse-day at 3*s.* 6*d.*

Cost of Seed.—In the case of fields Nos. 1 and 2 the seed consisted of 1 bush. each of tares and winter oats, together with 1 pk. each of rye and wheat in field No. 1, and 1 pk. of rye and ½ pk. of beans in field No. 2. In field No. 3 the seed consisted of 2 bush. of tares and 1 bush. of winter oats. The prices charged were those prevailing at the time of sowing.

Cost of Manures.—In the case of field No. 1 no manure was applied and the cost is, therefore, put at nil. In field No. 2 farmyard manure, made by fattening bullocks, was applied at the rate of 10 loads per acre, and in field No. 3 cow manure at the rate of 20 loads per acre was applied. The dung for field No. 2 was valued at 4*s.* per load, and for field No. 3 at 3*s.* per load, but it should be noted that at the present prices of straw and artificial manures these figures are somewhat low. The cost of carting and spreading was put at 9*d.* per load. In each case half the value of the dung and of the cost of carting and spreading has been charged to the silage crop, it being assumed that the other half of the manure remains for subsequent crops.

In the opinion of the writers farmyard manure, especially when

charged at its true value, is not the most economical manure to apply for the silage crop, when this consists principally of tares. Better results may be obtained by the use of 4 to 5 cwt. of basic slag on heavy soils, or a similar quantity of superphosphate on light, calcareous soils, to which in some cases potash should be added.

Cost per Acre.—It will be noticed that the cost per acre varies from £2 2*s*. 6*d*. in field No. 1 to £4 17*s*. in field No. 3; the chief reason for this variation is the wide difference in the cost of manure, though rental value also has an influence.

Crop per Acre.—These figures were obtained as explained in Table I.

Cost per Ton.—As in the case of cost per acre, the cost per ton varies considerably, viz., 5*s*. 4*d*. in field No. 1 to 6*s*. 11*d*. in field No. 3. From this one might be tempted to argue that it is not profitable to manure the tare crop, but a more reasonable explanation is, that during the growth of the silage crop on field No. 1 (unmanured) the fertility of the land has deteriorated, and that, therefore, 5*s*. 4*d*. per ton is not a reliable figure.

Cost of Filling Silo.—The following table shows the cost of cutting and carting the crop, chaffing it and filling the silo upon two different farms. The field numbers correspond with those in the earlier tables. In fields Nos. 1 and 2, in which the crops

TABLE IV.

	Fields Nos. 1 & 2.		*Field No. 3.*	
	No. of Men.	*No. of Horses.*	*No. of Men.*	*No. of Horses.*
Men and Horses employed per Day—				
*Cutting with reaper or mower [½ day]	½	1	½	1
Cocking or clearing tares from mower	1	—	2	—
Pitching	2	—	2	—
Driving, loading and unloading ..	3	5	2	3
Feeding	2	—	2	—
Treading in silo	1	—	1	—
Driving engine	1	—	1	—
Foreman [part time]	½	—	½	—
Total	11	6	11	4
Cost per Day—	£ s. d.		£ s. d.	
Cost of men at 3*s*. 6*d*. per day ..	1 18 6		1 18 6	
Cost of horses at 3*s*. 6*d*. per day ..	1 1 0		14 0	
Cost of coal	6 0		7 6	
Use or hire of engine..	15 0		1 0 0	
Total cost per day ..	£4 0 6		£4 0 0	
Weight of crop handled per day ..	31½ load × 19 cwt.= 30 tons.		153 tons ÷ 6¼ days= 24·5 tons.	
Cost per ton for cutting and filling ..	= 2*s*. 8*d*.		= 3*s*. 3*d*.	

* Half-a-day's cutting supplies sufficient cut crop for a whole day's filling.

were comparatively light, the crop was cut with an old-fashioned reaper, cutting one way, the sweeps being sufficient to clear the crop from the knives. In field No. 3, in which the crop was badly laid, it was necessary to employ four men to follow the mowing machine and clear the cut crop from the machine.

The first part of the table shows the number of men and horses engaged in the complete series of operations; it is seen at once that a considerable gang is required for economical working, and that, therefore, on small farms a certain amount of co-operation would be necessary to obtain this economy.

It will be noticed that approximately the same number of men and horses was used at each operation on each farm, except that in field No. 1 more men and horses were used for driving, loading and unloading than on field No. 3; this difference is explained by the fact that field No. 1 was situated nearly half a mile from the silo, whilst field No. 3 adjoined the silo. In other respects the costs are almost identical.

The weight of crop handled per day has been obtained in different ways; in fields Nos. 1 and 2 the number of loads handled each full day was recorded, and the mean of these has been multiplied by the weight of an average load; in field No. 3 the estimated capacity of the silo (153 tons) has been divided by the time taken to fill the silo.

The cost per ton of cutting the crop and filling the silo from these figures is seen to vary from 2*s*. 8*d*. to 3*s*. 3*d*. The lower figure, 2*s*. 8*d*., for fields Nos. 1 and 2, is perhaps hardly fair, because it does not take into consideration time lost owing to wet weather; in field No. 3 wet weather did occasion some delay, and in arriving at the higher figure this loss of time was included.

Cost per ton of Producing Oat and Tare Silage.—Table V. shows the total cost of producing a crop of oats and tares, and of filling them into the silo. It should be noted again that the reason why the crop on field No. 1 cost less than that on fields

TABLE V.

	Field No. 1.		*Field No. 2.*		*Field No. 3.*	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Cost per ton of green stuff for capital charges (see Table II.)	2	1	2	1	1	8
Cost per ton of producing crop (see Table III.)	5	4	6	8	6	11
Cost per ton of cutting crop and filling silo (see Table IV.)	2	8	2	8	3	3
Total cost per ton of crop as filled into silo ..	10	1	11	5	11	10

Nos. 2 and 3 is that no manure was applied to the first field, and no allowance has been made for the manurial constituents which

the crop has undoubtedly taken from the soil; consequently not much confidence should be placed on the figures for that field.

The capital charges on field No. 3 amount to 1*s*. 8*d*. per ton instead of 2*s*. 1*d*. per ton in the case of fields Nos. 1 and 2, the explanation being that the silo serving field No. 3 was erected in 1914, while the other silo was erected in 1915 when the cost of silo and cutter had considerably increased.

From the above table it seems fair to assume that the *cost of producing the silage crop and filling it into* the silo will amount to between 11*s*. 6*d*. and 12*s*. per ton, but there is still one factor to be considered, namely, the loss of material during fermentation in the silo. This fermentation may be considerable, especially if the crop be allowed to dry before it is put into the silo, but under the best conditions, and when air is excluded as far as possible from the silo by continual treading, the losses are much smaller. The limits of variation of this loss are given by American experimenters at between 10 and 20 per cent. Preliminary experiments by the writers, using small parcels of the cut crop buried in the silo, tend to confirm this estimate of loss. If it is assumed that the normal loss in the silo is 15 per cent. of the total, then the cost per ton of silage, as taken from the silo, will be from 13*s*. 6*d*. to 14*s*. per ton according to our preceding calculations.

Jaques, in a recent issue of this *Journal*,* calculates the cost of silage on his farm at 11*s*. 6*d*. per ton and includes in this estimate a cost of £1 per acre for cleaning after the crop is removed. In Jaques' case the manuring consisted of 5 cwt. of basic slag instead of dung, and this may be responsible for a reduction of 6*d*. or 1*s*. per ton in the cost. Jaques further estimates the capacity of his silo (16 ft. in diameter, 39 ft. high) to be 200 tons of silage. Figures published by the Silver Manufacturing Company gave the capacity of such a silo, filled with maize silage, at 173 American tons (1 American ton = 2,000 lb.). It is probable that oat and tare silage, when made under English conditions, though it contains less water than maize, packs tighter in the silo, since a longer period is generally occupied in filling; consequently heating begins and the silage settles greatly during the filling. Further information on the subject of the capacity of silos under English conditions is desirable.

In conclusion, the authors would wish to point out that the oat and tare silage crop is at present in its infancy in England; there are very many points which need careful study and experiment, and until these points are elucidated it is impossible to say how far the practice may be extended with profit. Probably

* *Journal of the Board of Agriculture*, March, 1916.

silage crops will not displace any large area of roots on the *medium soils*, where fine seed-beds can be easily prepared and where big crops of mangolds can be grown, but it would seem that the growing of an oat and tare crop for ensilage may be capable of wide extension on the heavy soils. If this can be shown to be economical, one of the obstacles (the necessity of the unprofitable bare fallow) to the extension of the wheat area will be removed. Again, it seems possible that many of the light sands and gravels, where early-sown root crops so often fail, might profitably be cropped with a silage crop in the autumn, to be followed by a late-sown root or green crop, such as white turnips or rape, if the weather is favourable in July or August.

In this article no mention has been made of the food value of silage. An experiment contrasting the feeding value of silage with mangolds has been carried out by one of the authors, an account of which was published in the June number of this *Journal*.

ON TAKING SAMPLES OF SOIL FOR SOIL SURVEYS.

E. J. RUSSELL, D.Sc.,
Director, Rothamsted Experimental Station.

IN the development of the system for providing expert agricultural advice it is of first importance that definite surveys should be made of each district to furnish the adviser with a ready source of information as to the general agricultural conditions prevailing in any part where he may be called upon to advise. One of the first to be undertaken would be a soil survey. Its object would be to describe the more important kinds of soil within the area, the crops found by experience to be the most suitable, and the systems of manuring found to be most effective. Not only would a soil survey be directly useful to the farmer, but it would also facilitate the work of the soil analyst by setting up standards to serve as a basis on which to interpret the results of analyses; as already pointed out in this *Journal* it is when such standards are available that a soil analysis is most likely to be of practical value.

Experience has shown that a soil survey is best carried out when the material is collected in the course of the general advisory and demonstration work in the counties, as it does not then involve a great deal of additional work outside the laboratory. It is important, however, that the collection of samples should proceed steadily, and, above all, that the greatest possible care should be taken to obtain only samples

that are really representative of the land from which they are taken. *It is by no means a simple matter to select a* few samples of soil, each only 2 in. across, to represent areas extending over hundreds or thousands of acres. Very much must depend on the judgment of the man who is taking the sample, and, whatever rules are offered for his guidance, he still has to use his own discretion very largely.

The problem has been discussed by Messrs. A. D. Hall, J. Hendrick, T. B. Wood, and the writer, and the following notes were subsequently drawn up in the hope that they might prove helpful to those engaged in the work.

In taking the samples of soil it is most important to bear clearly *in mind the object of the survey. The first series* of samples should be taken from typical soils; these should be carefully studied before sampling the exceptional soils.

It is obvious that the survey cannot be begun until the investigator knows something about the district. He requires three maps for the purpose: (1) the ordinary orographical map giving contours and elevations, marking the hill country and the plains; (2) the geological map, especially the large scale map showing the surface formations; and (3) the rainfall map which at the present he must draw up for himself from the data given in *British Rainfall*. All this information is necessary, because it will have a bearing upon the crop-producing capacity of a soil.

Soils may be studied from many points of view, but a soil survey is concerned only with the agricultural and vegetation characteristics. The investigator must, therefore, go over the district with the map and divide it up into areas within which similar agricultural and vegetation characteristics prevail. In moderately level countries these areas often agree tolerably well with the areas differentiated on the geological map and are, besides, large enough to be dealt with fairly readily. It frequently happens, however, that even on the same geological formation the soil conditions are not constant over any large area. The geologist is concerned primarily with the origin and history of the soil rather than with its actual properties, and if they are of common origin he may include sands and clays in the same formation without sharply defining them. The geological areas, therefore, only agree with the vegetation and agricultural areas when the nature of the soil is fairly uniform throughout. A good example is furnished by the London clay. In East Kent the soil on this formation is very heavy and intractable, but it becomes lighter as one travels

westwards, until in West Surrey it is a loam. There are also two or three distinct vegetation areas.

It very frequently happens that the region cannot be divided thus conveniently into areas of similar soil conditions. The formation may consist of alternations of sands and clays of no great thickness, so that the soil belts are not very wide and not always very definite. In this case the investigator cannot hope to get one typical soil; all he can do is to grade his soils between two limits, the lighter and the heavier, and to deal only in a general way with all the various intervening grades. Drift areas also often present considerable difficulty; the simplest course is for the investigator to make a general survey of the whole region to ascertain if there are areas of any size over which the agricultural conditions are similar. Where such areas are found they can be treated as separate units and described by themselves. Often, however, the soils are so intermingled that they can only be shown distinctly on large scale maps. In this case, again, no one sample can be typical of any soil except that immediately around the place from which it was taken; the analyst must, therefore, once more have recourse to the method of grading his soils between two limits. In parts of Hertfordshire, for example, gravels and stony loams are so inextricably mixed that no sample typical of any large area would be possible. All that can be done is to describe the gravels and the loams separately in some detail, and to deal only in a general way with the soils coming in between. Of course, where these occupy a large area they can be dealt with separately, but where they occur only irregularly this course is not possible.

In hill districts it is necessary to distinguish between the high land and the low land. Altitude plays a great part in determining agricultural conditions even when the soil is somewhat similar throughout. No general rule can be given as to where the line should be drawn; only observations on the spot can decide, and it may even be necessary to make three or more divisions. In this type of country isolated samples are of little value, and the method of grouping soils within limits is the only one practicable at present. The difficulty is particularly marked where slopes are steep, and river valleys narrow, as, for instance, in parts of Scotland and Wales.

The investigator must, therefore, expect to meet with two distinct cases: (1) areas which are so large and so uniform that typical samples can be taken, and can be considered as really representative of the whole area; here the sampling

is relatively simple. (2) Areas where the soils vary so much that no one sample represents more than the place from which it was taken; in this case it is necessary to take samples representative of the higher and the lower limits (*i.e.*, the heavier and the lighter types; the gravelly and the loamy, the higher and the lower land, etc.), and to examine them carefully; the intervening soils are then dealt with in a more general way.

In selecting the spots within these areas from which to take samples the investigator meets with fresh difficulties, for half a dozen or more kinds of soil may occur on one farm, while the native vegetation may also show considerable diversity. But these variations may, and often do, arise from small differences in the amount of calcium carbonate or of organic matter present, or in the water supply or management; these may affect the work of cultivation and the vegetation relationships, and give the impression of a wholly different type of soil. Since cropping, cultivation, etc., do not markedly affect the ultimate particles it is immaterial, for the purpose of a soil survey, whether the sample is taken from pasture land or arable land, but it is well to have a number of samples from both.

Having decided on the particular place where the sample is to be taken, very full enquiries must be made as to the agricultural value of the land, the crops and manure most suitable, the behaviour of the land during drought and wet weather, and any special points to be observed during cultivation. Information should also be obtained as to the most troublesome weeds, the native vegetation, hedgerow and other timber, etc., and note must be taken of the position of the soil in regard to water supply, the relation of the strata to the permanent water table, etc. When the soil type has been established by analysis the result must be correlated with the results of a series of manurial trials, before advice on the soil in question can be given to farmers with any degree of confidence. Rarely as yet can the response of a given soil to particular fertilisers be deduced from the analysis, though the conclusions reached at one place generally hold for other places similarly situated which analysis indicates as possessing the same soil type.

It is usual to take the sample to a depth of 9 in., and so many analyses have been made on this basis that much confusion would arise by adopting any other depth. Moreover, samples taken inch by inch have shown that any objection urged

against a 9 in. depth would apply equally to any other depth. This is shown by the analyses of arable and of grass soils contained in Table I. On the arable soil the nitrogen falls off slowly during the first 6 in. (the depth of ploughing), and more quickly afterwards. On the grass land the fall is rapid throughout. These figures show how necessary it is to keep to a uniform depth; it is obvious that the results would be considerably vitiated if one sample were taken to 8 in., and another only to 6 in. in depth.

TABLE I.

Variation in nitrogen content of successive inches of Soil down to the ninth inch on arable and grass land.

	Arable soil, Barnfield. February, 1913.		Grass land, The Park: March, 1913.				
Plot.	Dunged. 1 O.	Un-manured. 8 O.	Un-manured. 3	Full minerals. 7	Double nitrate and full minerals 14	Amm. salts and full minerals. 9	Triple Amm. salts and full minerals 11
1st in. ..	0·266	0·097	0·486	0·337	0·481	0·675	1·549
			0·436	0·462	0·436	0·674	1·489
2nd ,, ..	0·256	0·094	0·380	0·283	0·371	0·592	0·628
			0·366	0·306	0·347	0·350	0·551
3rd ,, ..	0·240	0·094	0·306	0·241	0·339	0·340	0·380
			0·314	0·247	0·314	0·287	0·375
4th ,, ..	0·238	0·096	0·273	0·218	0·302	0·271	0·300
			0·281	0·231	0·287	0·230	0·316
5th ,, ..	0·241	0·096	0·243	0·218	0·255	0·235	0·248
			0·252	0·220	0·258	0·209	0·279
6th ..	0·233	0·094	0·238	0·177	0·234	0·213	0·219
			0·225	0·184	0·213	0·193	0·250
7th ,, ..	0·191	0·096	0·213	0·147	0·190	0·203	0·198
			0·200	0·148	0·162	0·189	0·219
8th ,, ..	0·139	0·079	0·166	0·129	0·164	0·178	0·170
			0·159	0·131	0·144	0·168	0·183
9th ,, ..	0·124	0·061	—	—	—	—	—

Two separate sets of samples were taken from the grass land, and separate analyses were made. The results are given above.

A second sample is then taken from the tenth inch to a depth of 18 in.; where, however, a marked change occurs in the soil, the sample either of soil or subsoil should only be taken to the point where the change sets in. The subsoil sample may be no more typical of the formation than the surface

sample, but it affords a useful check, and helps in detecting abnormalities.

No general rule can be given as to the number of borings needed to make up one sample. Alluvial soils and brick earths are sometimes very uniform, and one single boring may give practically the same result as a mixture of eight. An instance is given in Table II.

TABLE II.

An exceptional case of a uniform Soil where one boring gave practically the same results as a mixture of eight.

Mechanical Analyses.

	Fine gravel.	Coarse sand.	Fine sand.	Silt.	Fine silt.	Clay.
1 boring	4·6	23·7	22·2	19·9	9·6	5·0
Mixture of 8 borings ..	3·5	24·4	22·4	19·6	11·1	4·7

Chemical Analysis.

	Loss on ignition.	Nitrogen.	P_2O_5.		K_2O.		Calcium carbonate.
			Total.	Available.	Total.	Available.	
1 boring	8·5	0·32	0·31	0·078	0·30	0·015	0·01
Mixture of 8 borings	*8·6*	*0·32*	*0·32*	*0·080*	*0·33*	*0·018*	0·001

In other cases there is greater diversity, and, as a rule, the sample should be made up of four to eight borings.

The probable error of sampling has been discussed by G. W. Robinson and W. E. Lloyd in a paper in the *Journal of Agricultural Science*, 1915, Vol. 7 pp. 144–153.

The most useful tool for taking the samples is the 2 in. cylindrical borer. For convenience, marks are made on the cylinder 9 in. and 18 in. respectively from the bottom, but periodical verification is necessary as the edges tend to wear away.

Soil Samples from Permanent Grass. Rothamsted, Collected October, 16th, 1912. Plot 17—Nitrogen Determinations.

Position of Sample.	Steel Frame. 6 in. × 6 in. × 9 in.	Auger. 1¾ in. diameter.
South End—		
Top depth	0·261	0·237
2nd ,, ...	0·088	0·102
North End—		
1st depth	0·218	0·202
2nd ,, ...	0·096	0·114

This tool gives practically the same result as the steel frame used by Lawes & Gilbert (9 in. deep, 6 in. × 6 in. sides). Samples taken with the screw auger in use elsewhere do not seem to be as satisfactory. On stony ground the cylindrical borer is difficult to work, and the steel frame or some equivalent may be found more suitable.

TABLE III.

Comparison of the Results of different Methods of Sampling. Agdell Field—Nitrogen Determinations.

Name of Sample.	Steel Frame, 6 in. × 6 in. × 9 in	Cylindrical borer. 2 in. diameter.	Auger, 1¾ in. diameter.
1st depth, 9 in. Fallow Plot	0·120 0·123 0·125 0·124 0·124 0·126	0·127 0·129 0·127 0·123 0·121 0·123	0·121 0·124 0·115 0·110 0·116 0·119
Mean	0·124	0·124	0·118
Clover Plot	0·144 0·149 0·142 0·143 0·149	0·150 0·147 0·139 0·137 0·136	0·146 0·149 0·134 0·135 0·127
Mean	0·144	0·141	0·136
2nd depth, 9 in.–18 in. Fallow Plot	0·089 0·074 0·071 0·071 0·078 0·074	— — — — — —	0·067 0·067 0·078 0·069 0·071 0·089
Mean	0·078	—	0·076
Clover Plot	0·087 0·088 0·070 0·077 0·090	— — — — —	0·078 0·079 0·085 0·079 0·078
Mean	0·081	—	0·080

Illustrations will be found in Table III, giving the results obtained on different plots by different methods of sampling. Four different samples were taken on each plot; each was separately analysed. In some cases two figures are bracketed; the lower ones were obtained by another worker drawing samples quite independently, but not far away. The results fully justify the use of the cylindrical borer, and they also show that the auger can be used on poorer soils.

A COUNTY SCHEME FOR TRAINING WOMEN FOR FARM WORK.

R. N. DOWLING, N.D.A.,

Agricultural Organiser to the Lindsey Education Committee, and Secretary to the County War Agricultural Committee.

THE parts of Lindsey, Lincolnshire, consist of nearly a million acres, practically the whole of which is farmed, the greater portion being arable land.

Women are employed very extensively in the south and north of the county, where the potato and intensive cropping areas are situated. It is curious, however, that outside these areas women's labour was practically unknown for many years. A most extraordinary prejudice existed on all sides. Farmers were exceedingly sceptical as to the possibility of getting local women to come out, and also as to the value of their labour on the land—so much so that it was of little use discussing the question. With a view to creating general interest and breaking down existing prejudices, the Lindsey Education and War Agricultural Committees considered and approved suggestions as to practical demonstrations of women at work on the land. Two demonstrations were organised, one being held in a district where women's labour was practically unknown.

The demonstrations resulted in a most unmistakable change in public opinion. Many farmers declared quite frankly that the demonstrations had altered their views, but asserted that nothing could be done, as the local women would absolutely refuse to work on the land. In this connection it was thought that if a certain number of women workers could be placed on farms in districts where women's labour was unknown, they would "set the fashion," and by force of example have a great effect on women and farmers.

The County Training and Clearing House Station at Elkington was organised in an attempt to do this, and to endeavour to

assist farmers by supplying a source of useful labour from outside.

By kind permission of Captain Smythe, owner of the Elkington Estate, and Lady Wilton, tenant of Elkington Hall, arrangements were made to start the station at Elkington, near Louth, on the 15th May, 1916. Here free instruction is offered, and board and lodging at 5*s*. per week, for courses of 2 weeks, or such longer or shorter period as may be deemed necessary, but the average period is 2 weeks. Wages are paid by the estate at the rate of 3*d*. per hour for work done that is of value to the farm, and these wages more than cover the cost of board and lodging.

The arrangements allow for 12 women at one time. The women are under the charge of a forewoman and are expected to carry out any work allotted to them—whatever is going on at the time, *e.g.*, weeding corn, hoeing roots, a little milking, haymaking, etc.

Applicants who take this course do so on the understanding that they are prepared to work on the land in the county of Lindsey, and that they will accept suitable positions, providing proper wages and accommodation are offered.

It was hoped that women of good education and also women of the industrial classes would apply and take up farm work for the summer months. Ladies who have already passed through the training station and are now filling posts on farms have, by their patriotic lead, given a great impetus to local women to come out.

Accommodation for 6 women is found free of charge by Lady Wilton. The parish handed over the local institute for meals and recreation; the whole of the cooking appliances and all necessary crockery, knives, etc., are supplied by Captain Smythe; Mr. Benjamin Stone, manager of the Elkington Estate, is acting as local secretary, and is responsible for the work each day, and also for the actual working of the scheme on the spot. Mr. Stone agreed to pay the women wages for work done which is of full use to the farm. He has also undertaken to have them conveyed to and from the station. The successful working of the station has been due to the untiring energy and help given by Mr. Stone. It would seem that such local assistance is a *sine quâ non* to the success of any similar undertaking.

The cook-matron was engaged out of the village, and is paid 15*s*. per week. The instructress is a Lincolnshire woman used to working on the land. She works with the students and receives 6*s*. per week over and above the wages paid by the

FIG. 1.—PLOUGHING at a demonstration of women at farm work. The Board of Agriculture farm costume and armlet are being worn.

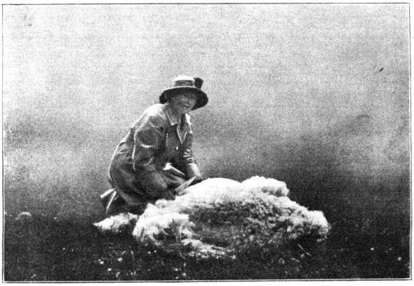

FIG. 2.—CLIPPING A LINCOLN EWE at a demonstration of women at farm work. This woman is regularly assisting her father at all kinds of farm work, including ploughing and sheep shearing.

FIG. 3.—WORKING DRAG OR CULTIVATOR. This girl (a farmer's daughter) feeds, gears up, and works her own horses all day she had never done work on the farm before this season.

estate. She has been supplied with a complete outfit from the Board of Agriculture by the County War Agricultural Committee, and wears a Government armlet.

Rules.—Each student must agree to be bound by the following rules in use at the training station:—

1. The period of training will consist of two weeks, or longer or shorter period as may be deemed necessary. The work consists of whatever is going on at the time, *e.g.*, weeding corn, hoeing roots, a little milking, haymaking, etc.

2. *Time Table.*

Morning rising ..	6.0 a.m.	Cease work ..	5.0 p.m.
Breakfast ..	7.0 ,,	Meat tea ..	5.45 ,,
Assemble for work	7.45 ,,	Bed time ..	9.0 ,,
Start work ..	8.0 ,,	Lights out ..	9.30 ,,
Dinner	12 to 1 p.m.		

Students for milking instruction to be at the dairy farm at 6.0 a.m.

3. Each student shall pay a fee of 5*s.* per week toward the cost of board, lodging and instruction, the 5*s.* to be paid at the end of each week to the local secretary.

4. *Wages*, at the rate of 3*d.* per hour, will be paid at the end of each week by the local secretary for work done of value to the farm. The decision of the local secretary as to the value of work done is absolute and final. The wages generally more than cover the board and lodging fee.

5. Every student will be expected to take her turn to help the cook-matron in preparing meals, etc., and to take the mid-day meal to the other students if they are working at too great a distance to allow them to return home. This will probably mean about one day out of the two weeks of training to be given to assist the matron.

6. Students shall be under the direction of an appointed forewoman instructress and must carry out her orders and instructions when at work.

7. Students, when not at work, shall be under the care and control of the cook-matron and will be expected to assist her as she may consider necessary.

8. Students shall undertake to keep in order their own bedrooms make their own beds, and perform all domestic duties incidental to the use of the rooms. This must be done before breakfast.

9. Students will be liable to dismissal for any serious breach of discipline or non-compliance with rules.

Students must write as early as possible to the local secretary (Mr. B. G. Stone), before coming, stating time of arrival at Louth Station, G.N.R., in order that they may be met at the station and conveyed to South Elkington.

Local Hon. Secretary: Benjamin G. Stone, Elkington Estate Office, Louth.

Organising Secretary: R. N. Dowling, 286, High Street, Lincoln.

Copy of letter sent to all applicants, together with rules and a covering letter of explanation. The applicant is requested to sign the letter and give names of referees :—

I have received and carefully read through the copy of rules and covering letter as to fee payable for a short course of training at the above station. In the event of my being selected for a course of training I agree to conform to such rules and conditions.

I am healthy and strong, and prepared to work regularly on a farm in Lindsey during the whole of the present season if a suitable position is offered.

Name to be signed here
Address
Date

Give name and address for two references.
1. Name
Address
2. Name
Address

Register.—A copy of the following register is carefully kept:—

Register and Particulars of Students Trained.

Name of student.	Where supplied from.	Date of arrival.	Date of departure.	Where placed out.	Remarks.

Accounts.—A duplicate order form book is kept and no goods are supplied without a proper order being issued. The accounts are paid monthly, and the following will be of interest as showing the exact expenditure over a period of 4 weeks:—

Statement of Accounts for four weeks ending 4th June, 1916.

	£	s.	d.
To Bacon	2	7	4
,, Butcher's meat	7	10	4
,, Coal	1	8	6
,, Bread	2	1	8
,, Groceries	2	8	7
,, Eggs, milk and potatoes	3	15	1
,, Wages of cook-matron at 15*s*. a week	3	0	0
,, Part wages of instructress at 6*s*. a week	1	4	0
,, ,, ,, instructor in milking at 2*s*. a week ..	0	8	0
,, Bedroom accommodation for 4 beds in the village at 2*s*. 6*d*. a week each	2	0	0
	26	3	6
Less amount received from students at 5*s*. per week each	9	2	6
Net total expenses	£17	1	0

It may be stated that 19 students completed the full time of 2 weeks, while 3 students completed half time of 1 week. This is equal to 20½ students at full time, or a *cost of 8s. 4d. per student per week*. Of the 22 students, 17 are now working in permanent places on farms, and five were sent home as unsatisfactory.

Wages.—It was decided that the minimum wage to be paid to students by farmers should be accommodation and 16s. per week, or board and lodging plus 6s. per week. There is no difficulty in obtaining these terms, and in some cases higher wages are being paid, *i.e.*, 3s. for a day of 9½ hours

Class of Women.—Women of the industrial and of the well-educated classes have passed through the station. It is found that farmers prefer the latter class, although all those placed have given satisfaction.

Nature of Work.—Most farmers require the women to do weeding and similar work. Instances have occurred, however, where girls who have a knowledge of horses have at once, by their own desire, been put to horsework.

Results Obtained.—There is ample evidence to show that the example set by these women has been readily followed in the districts where they are placed. One farmer engaged a girl to work horses with his daughter. He had no women at work prior to this arrangement. Within two weeks he had 10 women at work besides his daughter and the girl from the training centre.

The district was one of the worst in the county so far as prejudice was concerned, yet the example set has been followed in a most surprising manner by many farmers and women.

In another area where women's work was unknown, some of the station students started work, and before long a farmer's wife organised a gang of 10 women from the village (including two maids from the Hall) and works with them all day.

Ventilated and Unventilated Milk Churns.

TWO sets of experiments dealing with the advantages and disadvantages of ventilated and unventilated churns have been carried out at the Dairy Research Institute, University College, Reading. The first set was conducted by J. Golding, F.I.C., F.C.S., and R. Stenhouse Williams, M.B., B.Sc., and the second set by R. Stenhouse Williams and Elfrida C. V. Cornish, M.Sc.

First Reading Investigation.—The first set of experiments involved an enquiry into the conditions obtaining in England

and abroad, and investigations concerning the chemical and bacterial content of milk carried in the two types of churn. The results of this enquiry may be epitomised as follows:—

(1) Ventilated churns are not found necessary in America, Denmark and Switzerland. Thus Eastwood, writing in 1909, says: "All the American cans I saw were covered with a closely-fitting metal lid (the Boston wooden plug seemed to be going out of fashion). The upper surface of the lid was generally convex, with the rim slightly projecting beyond the mouth of the can. None of the lids were perforated. In only a few cases did I find that the cans leaked. Whilst feeling that the Americans might with advantage attach more importance to the sealing of cans, I fully admit that they are greatly in advance of the Old Country in the matter of protecting milk from contamination during transit."

(2) Enquiries made from four large dealers in churns in this country showed that the better class of milk-dealer is buying an unventilated churn; he would not do this if he thought it had an unfavourable effect on his milk. One of these firms wrote: "On going through our churn bookings for the last 4 years, we find that the average works out at about 300 to 1 in favour of non-ventilated churns. . . . The ventilation in the covers of churns has been abandoned by the better-class dairies, owing to the dirt working through to the milk when churns are being rolled by railway porters during transit."

(3) Those who deal in the cleanest type of milk, cool and hermetically seal it as soon as it comes from the cow. No complaints are received from their customers.

Why, then, is the ventilated churn in use? It probably arose from the fact that if milk contains "cow smell" producing organisms, and is enclosed in a vessel with a more or less tightly-fitting lid, then in a few hours the odour is more likely to be marked than it would be in a vessel having some means of ventilation. Milk, as it comes from the udder, does not contain "cow smell" producing organisms. This is proved by 1, 2, and 3 above, and also by much experimental work, conducted by Bergey, Henderson, Houston, etc. These organisms are introduced into the milk after it has left the udder, and are chiefly derived from cow-dirt. If the milk contains these organisms and then be sealed, when the churn is opened the smells which they have produced will be obvious. If, on the other hand, the milk be placed in a ventilated vessel, the smell will be much less distinct, or even absent, because it has been allowed to

escape through the ventilating holes, and, therefore, one evidence of bad milk production is lost.

The conclusions of the investigators were that, although the actual chemical and bacteriological differences between the two types of churn did not vary much, the unventilated type was better than the ventilated type because: —

(1) It prevents the introduction of dust during transit.

(2) Splashing of the milk on to the lids and its return into the churn after becoming infected with dirt is avoided.

(3) It helps to reveal the cleanliness or otherwise of the methods of milk production.

Second Reading Investigation.—It was suggested that a ventilated churn might be constructed in which the air would be filtered before it was admitted into the churn, and that in this way two possible results might be obtained: first, that dirt would not be permitted to enter the milk, and second, that the purified air might have some beneficial effect upon the keeping properties of the milk. The second investigation was, therefore, commenced early in 1915 in order to obtain information on the possibility of filtering the air admitted to ventilated churns and the effect on the milk.

Orr* has shown that a great deal of the dirt in milk is introduced at the time of milking. If, then, filtered air is to exercise any beneficial effect it must counteract the deleterious changes wrought in the milk by the introduction of dirt into it in transit from the cow's udder to the churn. If filtered air has any beneficial effect upon the keeping properties of milk, it should be possible to demonstrate this by an examination of any alterations in the bacterial count and by variations in the acidity or alkalinity of the milk. This, therefore, was done, but before a description of the actual experiments is given, it may be pointed out that a considerable amount of work has been carried out upon the bactericidal power of one of the constituents of air, namely, oxygen, and also upon the bactericidal effects of oxides of nitrogen, which sometimes occur as impurities in air.

The experiments of Moore,† Stenhouse Williams† and Adams‡ showed: (1) That a very limited number of organisms is affected by growth in excess of oxygen; (2) that the percentage of oxygen must be very high in order to produce any inhibitory effect at all; and (3) that inhibition of growth was not due to oxides of nitrogen sometimes present in the air. It is, however,

* J. Orr: Report on an Investigation as to the Contamination of Milk, 1908.
† Moore and R. Stenhouse Williams: *Bio-Chemical Journal*, Vol. 4, p. 177, 1909; and Vol. 5, p. 181, 1910.
‡ Adams: *Bio-Chemical Journal*, Vol. 6, p. 297, 1912.

by no means certain that even the limited success obtained in the tests mentioned would follow on the passage of these gases ordinarily through milk.

It was thought possible, however, that some other factor might be present in filtered air which might exert a beneficial action upon the keeping properties of milk, and the experiments described below were designed to test the existence or nature of such effects.

In order that the milk might be tested under varying atmospheric conditions, the trials were carried out over a period of five months. An endeavour was made to make the experimental conditions as nearly as possible comparable with those under which milk is usually obtained, and to cover completely the whole period of time which might reasonably be supposed to elapse between the drawing and delivery of the milk. It was considered desirable to use milk taken under average conditions of cleanliness. The milk used, therefore, had a bacterial content of from 4,000 to 30,000 in 1 cc. within three hours of milking, and was not free from outside contamination, though it was not dirty milk in the ordinary acceptance of that term.

Ten separate experiments were made, and, in order to establish comparative tests, three samples of milk were examined in each case. Two quarts of milk were introduced into each of three sterile Winchester flasks, one of which was closed with a glass stopper, the other two being arranged so that unfiltered air was aspirated through one and filtered air through the other. The sterility of the filtered air was tested by means of a nutrient broth-tube, and on no occasion was growth found in the tube after three days' incubation at 37° C.

The measure of the cleanliness of the milk was calculated by estimating its bacterial content and its acidity at various stages of the experiment. For the bacteriological examination of the milk samples, 1 cc. of each was taken and, after dilution, was plated upon whey gelatine and incubated at 22° C.; on one occasion the milk was also plated upon whey agar. For the acidity determinations, two sets of experiments were made simultaneously of each sample of milk: in one, titrations were made with a caustic-soda solution, and in the other, the acidity was tested electrometrically.

The quantity of air passed through the ventilated flasks varied from 14 to 17 litres during 24 hours, it being felt that smaller quantities were very unlikely to produce any effect upon the keeping qualities of the milk. The milk was allowed to stand

for a certain period after milking, 3, 4 and 15 hours thus elapsing in different experiments.

Six of the experiments were conducted in the laboratory, and laboratory air, filtered and unfiltered, was allowed to pass through the flasks. It may be noted that there is little dust in the laboratory.

In the remaining four experiments an attempt was made to expose the milk to conditions as closely as possible resembling those which prevail during transit. Evening milk was obtained and kept in the laboratory over night; the experiments were begun at 6 o'clock in the morning, 15 hours after milking, and continued until 9 o'clock at night, when the last of the samples was taken. The flasks were set up in the College grounds, close to the road, and any dust raised was thus allowed to enter the unfiltered, ventilated sample. The road, however, has a smooth surface, and there is not much dust. In two of these experiments the flasks were protected from direct light, while in the other two they were unprotected.

Detailed tabular statements and charts were prepared showing the results obtained in each experiment. These are not reproduced here, but it may be briefly stated that while considerable variations were found to occur in the figures representing the number of bacteria and the relative acidity of the milk in the three samples tested in each case, no consistent difference could be traced throughout the series which might demonstrate any actual advantage that could be derived from any of the three methods of treatment. None of the methods appeared to inhibit the growth of organisms, but it was noted, as a rule, that the greatest increase in the bacterial count occurred after the twelfth hour of treatment.

The conclusions drawn were, that if the whole series of experiments be considered, it does not appear that the passage of filtered air through the milk exerted any appreciable effect, either upon its bacterial content or upon the acidity of the samples. It cannot, therefore, be said that the filtered air tended to increase the keeping properties of the milk.

The Price of Milk.

THE usual retail price for milk in large towns before the War was 4*d.* per qt. throughout the year; last winter this retail price seems, as a rule, to have been raised to 5*d.*, and recently the price has been increased by a further 1*d.* to 6*d.* in a number of districts, this giving rise to an agitation on the part of consumers (notably in London) with suggestions as to action with a view to a reduction in price. The circumstances suggest that a brief review of the position of the milk trade may be of interest.

Contract Prices.—The following statement shows the average contract prices at London, Birmingham and Manchester from 1913 to 1916, the prices being taken from returns furnished by the Board's reporters (the figures are given as pence per imperial gal.):—

	Lady Day Contracts.						*Michaelmas Contracts.*	
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov. to Mar.
London.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
1913..	7½	7½	7½	7½	7½	7½	10¾	10¾
1914..	8	8	8	8	8	8	10¾	10¾
1915..	9½	9½	9½	9½	9½	9½	13½	13½
1916..	14	12	12	14	14	14	—	—
Birmingham.								
1913..	9	7	7	7	7	7	10½	10½
1914..	9	7	7	7	7	7	10½	10½
1915..	9½	9½	9½	9½	9½	9½	12½	12½
1916..	13½	11	11	13½	13½	13½	—	—
Manchester.								
1913..	7½	7½	7½	7½	7½	7½	10¾	10¾
1914..	7½	7½	7½	7½	7½	7½	10½	10½
1915..	9½	9½	9½	9½	9½	9½	12½	13½
1916..	14	12	11¾	13	13	13	—	—

It will be seen that under the contracts made last Lady Day for the 6 months April to September, 1916, the prices generally secured by producers averaged about 13¾*d.* per imperial gal. for April, 11¾*d.* for May and June, and 13½*d.* for July, August and September. These prices are slightly above those ruling last winter and are, on the average, 3½*d.* (37 per cent.) per imperial gal. above the prices contracted for at Lady Day last year, and 5½*d.* (73 per cent.) above those obtained under the contracts made at Lady Day, 1913 and 1914.

The Dealers' and Retailers' Profits.—Comparing the prices in July, 1916, with those in July, 1913, it is evident that the dealer now has to pay the farmer 6½*d.* more per gal. in the case of the London and Birmingham contracts and 5½*d.* more in the case of the Manchester contracts; the rise in the retail

price has been $4d.$ per gal. (in some districts $8d.$ per gal.), so that it appears that the dealers and retailers are making $1\frac{1}{2}d.$ to $2\frac{1}{2}d.$ per gal. *less* profit in some districts and $1\frac{1}{2}d.$ per gal. more profit in other districts than before the war.

In connection with dealers' and retailers' profits, the following points should be borne in mind:—

(1) It was frequently urged before the War that the usual retail price of $4d.$ per qt. was not remunerative to the retailer when he was paying the higher contract prices prevailing during the winter months, and that he was dependent on summer prices to make his business profitable.

(2) Both dealers' and retailers' working expenses are unquestionably heavier than they were before the War, owing to increased wages and (where horses are kept) the increased cost of fodder.

The Farmers' Profits.—The reasonableness of the increase in the price paid to the farmer is a difficult question, as it is impossible within a short time to measure with any degree of accuracy the increased cost of production of a gallon of milk.

In the first place it must be remembered that the farmer's profits are not to be judged merely by the prices and cost of production at the present season; regard must also be paid to the return obtained during the winter months, when expenses are heavier and the yield of milk is at its lowest.

Prominent among the expenses are those in respect of (i.) wages, (ii.) feeding-stuffs and (iii.) milking cows.

(i.) As compared with a rise of approximately 20 per cent. in the contract prices between Michaelmas, 1915, and the same date in 1913 and 1914, the wages bill of the dairy-farmer increased in at least as high a proportion, while allowance must also be made for the great difficulty in obtaining milkers, which has made the business of the dairy-farmer much more harassing and arduous than in normal times.

(ii.) The rise in price of feeding-stuffs (which are essential in winter) was very much more than 20 per cent. Bran, for instance, increased in price by 60 per cent. in January to March, 1916, as compared with 1912-1914; the advance was 40 per cent. in the case of linseed cake, and other feeding-stuffs showed similar increases.

(iii.) The cost of first quality shorthorns in milk, which averaged £24 in the first 3 months of 1913-14, and was only a

few shillings more in 1915, rose to over £29 in the same period in 1916. In April a further average rise to £31 7*s*. was recorded, and prices are still rising.

The most practical test on the point of the profits of the farmer is that farmers are reducing, rather than increasing, their dairy herds, and, further, that the output of milk is diminishing, if the high prices paid for "accommodation" milk throughout the greater part of the winter be taken as the criterion.

Lastly, the remuneration from dairying cannot be considered apart from other branches of the farmer's business. Better returns are at present being obtained from meat than milk; thus, the mean price of third quality shorthorns (largely made up of dried cows) at English markets in January to March of this year (3 months before the milk contracts were made) as returned by the Board's market reporters, was 9*s*. 7*d*. per stone of 14 lb., as against 7*s*. 3*d*. in 1913 and 1914, an increase of over 32 per cent. There has been a marked tendency to dry off stock for slaughter and so take advantage of these prices.

Somerset Scheme for the Distribution of Scotch Seed Potatoes.

EARLY in the present year the Agricultural Instruction Committee of the Somerset County Council adopted a scheme to provide for the distribution of Scotch seed potatoes amongst allotment holders and small cultivators throughout Somerset, experience having led to the belief that the average yield of potatoes on allotments in the county could be increased by at least 50 per cent. by this means. Steps were taken to bring the scheme to the notice of those interested, a circular setting forth the particulars of the scheme being sent to the chairman of every parish council and parish meeting and to the clerk of every borough council and urban district council. It was proposed that the parish councils or meetings should appoint a person in each village to ascertain the quantity of seed potatoes required, to arrange for their distribution and to collect cash. A choice of three main crop varieties was offered, viz., Arran Chief, Up-to-date, and Dalhousie, at 7*s*. 6*d*., 6*s*., and 6*s*. 6*d*. per cwt., respectively, delivered in cwt. bags to the nearest railway station; no grower was allowed to obtain more than 5 cwt. of seed; and cash had to be sent with the order.

Orders for potatoes came in from practically all parts of the county, and to a much greater extent than was expected; by

23rd February orders for 200 tons had been received, for which £1,375 was forwarded; the money sent with orders received thereafter was returned. The orders accepted were received through 216 different individuals, and probably represented between 3,000 and 4,000 individual buyers.

The wholesale order was placed by Mr. J. H. Burton, M.Sc., the Agricultural Organiser for the county, with an Edinburgh firm at the following prices per ton f.o.r. in Forfar or Perthshire in 1 cwt. bags:—Arran Chief 95*s*., Up-to-date 70*s*. and Dalhousie 70*s*.

It was found that the potatoes would have to be sent to 73 stations; but these were arranged in groups, so that the bulk of a load was sent to one centrally situated station, and the remainder redistributed to other stations in the same area; in this way the number of areas was reduced to 28.

Unfortunately, immediately after the order had been placed a severe and prolonged storm set in in Scotland, and lasted till nearly the end of March; this hindered the opening of the field clamps of potatoes and the dressing and bagging. By the end of March, however, about three-fourths of the quantity required had been dispatched. Thereafter a suspension of all traffic between Scotland and England ensued owing to the movement of troops. By 15th April, however, 187 tons had been dispatched and the orders for the remaining 13 tons were cancelled, money being returned where orders were not carried out, so that an opportunity should be given for the orders to be placed elsewhere. In every case where potatoes were not supplied a payment was made of the difference (if any) between the price at which the potatoes were offered and the price which had to be paid locally.

Generally speaking, the Up-to-dates and Dalhousies gave every satisfaction, but complaints were made of the quality of the Arran Chiefs. In the latter case potatoes of very large size were sent. This was due to the fact that the vendors could not, at the time the order was given, undertake to supply the quantity required of seed size and the order was, therefore, given for seed and ware. In view of the stormy weather in Scotland in March, growers who had contracted to deliver seed and ware could not be expected to do much hand-picking in spite of the stipulation at the time the order was given that coarse tubers should be picked out. It should further be remembered that there need not be any serious objection to ware in the case of "Arran Chief," as this variety stands cutting well.

Another cause of complaint was that, although new bags were stipulated for at the time of placing the order, old ones

were used in some cases with resulting breakage and the occasional mixing of the potatoes in the trucks. It is unlikely that any blame rests on the vendors in this connection as they would no doubt have been very glad to supply new sacks, had they been procurable.

As regards the financial aspect of the scheme, the amount refunded for the 13 tons of unfulfilled orders was £100, leaving the total receipts for potatoes at £1,275. The amount paid for potatoes was £853, and the carriage amounted to £327; the expenses of the scheme were £16. There was thus a profit of roughly £79 after covering all expenditure, and this amount will be held for future use. This large profit was due to the unexpectedly large quantity of potatoes ordered and to the consequently cheaper cost of carriage and of distribution of the potatoes ordered.

In view of the difficult circumstances in which the work was carried on, the Agricultural Instruction Committee and Mr. Burton are to be congratulated on the success which attended the scheme.

Schemes of a similar nature to the above, if of less magnitude, for the distribution of seed potatoes, have been in operation during the past spring in several other counties, notably Sussex, Westmorland, Monmouth, Carnarvon, Flint and Montgomery. In February last the Board addressed a circular letter to County War Agricultural Committees calling attention to the Somerset scheme and asking the Committees to consider the possibility of the organisation of a similar scheme in their respective counties.

As regards the Somerset scheme, most favourable accounts are being received of the very strong growth the potatoes are making, and there is every prospect that when the potatoes come to be dug the scheme will prove even more successful than was expected in increasing the yield amongst allotment holders and small cultivators.

Palm Kernels and Palm-Kernel Cake.

IN June, 1915, a Committee was appointed by the Secretary of State for the Colonies to "consider and report upon the present condition and the prospects of the West African trade in palm-kernels and other edible and oil-producing nuts and seeds, and to make recommendations for the promotion in the United Kingdom of the industries dependent thereon."

The Committee have recently issued their Report [Cd. 8247, price 5*d*.] (which was published last month), and in view of the magnitude and value of the trade in palm-kernels, and of the fact that all but a small fraction of the kernels exported from the British Empire in the last 30 years went to Germany, the Report is chiefly devoted to the trade in this product. The question at issue is between Germany and the United Kingdom.

The Committee are satisfied that ample capacity can be provided in the United Kingdom for crushing the whole of the kernel crop, and that all the oil and cake produced should soon find a ready sale. They are, however, clear on the point that the industry will not have become sufficiently rooted in this country by the end of the War to overcome successfully the competition which it will then have to meet from Germany. To prevent the reversion of the bulk of the trade to Germany, the Committee recommend the imposition at an early date in the several West African Colonies of an export duty of not less than £2 per ton on all palm-kernels exported from British West Africa, the duty to continue during the War, and for 5 years afterwards, and to be remitted on all kernels shipped to, and crushed in, any part of the British Empire; if this £2 duty be found insufficient to divert the trade to this country, it is stated that the amount should be raised until the duty is adequate to effect its purpose.

Against the decrease in demand due to the loss of the German market as a result of the duty the Committee set the great expansion of the British home market which is taking place, as well as the increasing demand for edible oils throughout the world, and they think that these latter factors will operate against any tendency to lower prices; the Committee do not believe that any very serious risk exists of combinations in the trade.

Since the principal use of palm-kernel oil will be for edible purposes, and predominantly for making margarine, and since the consumption of margarine in this country is rapidly increasing, the Committee recommend that it be made legal to add the words, "British made," to the word "margarine" on the statutory wrapper, and that the Food and Drugs Act be amended accordingly

Lastly, the Committee consider it advisable that the Agricultural and Forestry Departments of the West African Colonies should take measures for the careful investigation of the properties of the several varieties of oil palm in each colony and of the best methods of cultivation of the species which are considered most suitable for economic purposes.

Use of Cake and Meal for Feeding.—Crushing and extraction are alternative processes for obtaining the oil from the kernel when it has been ground. When crushed, the kernel, ground small, is heated, placed in a special press and subjected to a very high pressure, the resultant cake being proportionately hard. When the process of extraction is used the kernel after grinding is placed in a special cylinder and mixed with a solvent; the solvent passes through to another receptacle, carrying the oil with it; the solvent is then recovered by distillation and the oil remains. The resultant feeding-stuff is a light and fluffy meal, unsuitable for use in the open, but capable of being used for making compound cakes, or for indoor feeding in the form of meal for pigs or other animals.

The Committee recognised the excellent work done throughout the country both by the Board of Agriculture and Fisheries and by agricultural colleges in bringing palm-kernel cake and meal prominently to the notice of agriculturists, and they recommend that the efforts to extend the knowledge and use of palm-kernel cake amongst farmers should be continued.

The experiments carried out so far in this country with the newer cakes are described and examined in an appendix to the Report by Dr. Crowther.*

With regard to the use of palm-kernel cake for *fattening cattle* the Norfolk, Cambridge, Aberdeen, Glasgow, Aberystwyth and Edinburgh experiments in 1914-15 are reviewed, and Dr. Crowther states that the following conclusions may safely be drawn:—

(1) Palm-kernel cake is a suitable food for fattening cattle.

(2) When fed along with adequate amounts of roots, hay, or straw (or both), and corn (or other concentrated food), it is capable of giving results roughly equal to those given by the same weight of linseed cake, decorticated cotton cake, or dried distillery grains, and definitely superior to those given by the same weight of Bombay cotton cake or bran.

(3) In rations supplying only relatively scanty amounts of digestible protein it will probably prove inferior to linseed cake and decorticated cotton cake; for this reason the results of comparisons with these foods are likely to vary greatly.

* See also the article by Dr. Crowther at p. 305 of this *Journal*.

(4) The evidence available is not sufficient to enable a statement of the precise relative feeding-values of these foods to be given.

Experiments at Hutton Farm (Lancs), 1914, Harper Adams College 1914-15, Armstrong College 1914-15, Leeds 1914-15, and Bangor 1915, are held to demonstrate clearly that palm-kernel cake is a suitable food for *dairy cows*, although furnishing no reliable guidance as to its precise value in comparison with the other foods used; taken as a whole, the results available show little evidence of any appreciable specific influence of the palm-kernel cake upon the production of milk-fat. Where observations have been made on the quality of the butter produced during the feeding of rations containing palm-kernel cake, even up to $7\frac{1}{2}$ lb. a day, no appreciable detrimental effect has been noted.

With regard to the palatability of the cake, practically all the various experimenters record that it is at first not greatly relished by cattle and needs to be introduced gradually into the ration; in the majority of cases it is reported that although the cattle soon ate the cake they did not do so with the same evident relish as is displayed towards linseed and cotton cakes.

The Committee lay special stress on an extensive experiment* carried out in Germany some years ago on dairy cows, the results of which showed that palm-kernel cake definitely increases the amount of milk-fat; the increase varied with different animals from 0·16 per cent. to 0·34 per cent.

Evidence was received by the Committee that palm-kernel residue is very suitable for *pigs*, a fact which will have an important bearing on its future as a feeding-stuff, since cotton cake, its chief competitor among the cheaper oil cakes, is unsuitable for pig-feeding.

With regard to the keeping qualities of palm-kernel cake Professor Wood submitted to the Committee the results of an investigation, according to which the tendency of palm-kernel cake to become rancid is due to the presence of a fat-splitting ferment, which, under suitable conditions (warmth and moisture), is able to decompose the fat left in the cake, liberating fatty acids, which have a rancid odour. The results show, further, that if the cake is kept cool and dry this rancidity does not occur, and also that the fat-splitting ferment becomes inactive when the cake is heated to 70°C. Apparently, therefore, all that is necessary to insure that palm-kernel cake shall not develop rancidity on keeping is to see that the heating

* See this *Journal* for July, 1911, p. 335, and also p. 305 of this issue.

by steam of the ground kernels, which is an essential preliminary in the manufacturing of cake, is efficiently carried out, as this will render the ferment inactive and so prevent any development of rancidity from this cause, even if the cake is not very carefuly stored. Mills with suitable machinery have been and are being erected, so that a cake of satisfactory keeping quality may be anticipated.

The following are given by the Committee as the usual variations in the percentages of the chief constituents of palm-kernel cake and meal, together with the average composition:—

	Cake.		Meal (extracted).	
	Variations. Per cent.	Average. Per cent.	Variations. Per cent.	Average. Per cent.
Oil	5·5—7·5	6·5	1·75—2·25	2·0
Albuminoids	17·0—19·0	17·0	19·0—20·0	19·0
Carbohydrates	42·0—48·0	46·0	49·0—52·0	50·0

Dr. Crowther, in his evidence before the Committee, placed the relative values of 1 ton of average samples of linseed cake, palm-kernel cake and Egyptian cotton seed cake at £11, £7 13*s.* and £6 12*s.* respectively.

As subjects for further investigation the Committee suggest: the specific effect of the food on milk-fat; the effect on fattening cattle, especially with regard to "bloom"; methods of using the meal in pig-feeding; the best means of blending it with other foods for cattle; and, lastly, the subject of rancidity in cake.

THE *following note on the growth of carrots and turnips as catch crops in Belgium has been communicated to the Board by* Mr. H. Vendelmans:—

Carrots and Turnips as Catch Crops.

In some parts of Belgium carrots and turnips are practically always grown as catch crops. Carrots are sometimes sown in rape, and when the latter is harvested the carrots remain. These carrots need cleaning, and often receive a top-dressing of nitrate and superphosphate. More interesting, however, is the sowing of carrots in winter wheat. Just before the ears are formed the seed is sown broad-cast on the field. Obviously it cannot be rolled, but as it reaches the soil easily and is protected from the direct rays of the sun by the shade of the corn, it is able to sprout. A little more seed is used than in ordinary methods. At harvest time the young carrot plants are about 2½ or 3 in. high, and are not affected by the harvesting. They are still weak, but the roots have penetrated well into the soil and are temporarily secure against drought. Immediately after cutting the wheat the field is

harrowed and sometimes spread with liquid manure. The harrowing kills the weeds and keeps up the water supply by checking evaporation. The carrots take possession of the field at once, and so a valuable winter crop is obtained cheaply.

Great advantage results from having the carrots growing and their earliest stage past before the field is cleared. There is a considerable gain in time, which makes all the difference in the bulk of the crop at the end of the season. Besides, it would be impossible to sow at harvest time, owing to dry weather. The crop is obtained without any additional work beyond harrowing. No ploughing or cleaning of the field is required during the earlier period of growth, and it may be added that the catch cropping of carrots has a beneficial influence on the general cultivation, because it induces the farmer to plough the corn land deeper.

Turnips are treated in quite a different way. They are not sown in the corn crop; but immediately after harvesting, while the corn stooks are not yet carted, the field is lightly ploughed. Very often before ploughing the soil receives a slight dressing of stable manure, but more often an application of superphosphate and sulphate of potash is given afterwards. Sowing is followed by harrowing and rolling. As soon as the corn is gathered the strips on which the stooks were standing are worked and sown, so as to finish the field. Ploughing at once after the cutting of the corn is important for the success of the crop. If the soil remains unploughed the air considerably exhausts the reserved water by capillary action, and in this case, if no rain supervenes, the regular sprouting of the seed is often hindered. By immediate and shallowing ploughing, followed by harrowing, on the other hand, evaporation to any depth is checked, while the surface contains sufficient water to encourage sprouting. Once the root has reached a little below the surface the turnip stands drought quite well.

Both of these crops are useful for taking up large quantities of the nitrates formed in the soil, at the end of the season, which would otherwise be partly or totally lost.

The Preservation of Fruit.

IT is highly desirable that every effort should be made to preserve in some way for future use all fruit, as it comes in season, that is not required for immediate consumption. In ordinary times there is commonly a very considerable loss of fruit in seasons when crops are good or exceptionally heavy—but such

loss should not occur at a time like the present, when it is essential that all kinds of foodstuffs should be produced in as large quantities as possible, and preserved in some way when naturally of a quickly-perishable nature. In the orchard and garden of the large farm, on small holdings, and in private gardens, it is almost invariably the case that there is a surplus of fruit which, unless proper care is exercised, may readily be lost. The bottling and preservation of fruit should not be left exclusively to the large manufacturers, but small growers and private householders should consider carefully whether it is not possible for them to preserve for sale, or add to their store-room a very valuable lot of fruit bottled, dried, or in the form of jam.

It may be contended that sugar is dear and difficult to obtain. That is perfectly true, but nearly everywhere it is possible to obtain small quantities at a time, and by economising in cooking much may be saved. Glucose, moreover, which is sold under the name of corn syrup, has exactly the same preserving and energy-giving qualities, and if glucose is used in the proportions of one part to two or three of sugar it is possible to make 25 to 33 per cent. more jam than if sugar were used alone. Glucose can now be obtained in small quantities of about 5 lb., and during the present fruit season will be much cheaper than sugar. Further, fruit can be readily and thoroughly preserved in first-class condition without the use of sugar. The principal charge is for glass bottles, and in this connection it may be pointed out that (1) the bottles and fruit, together with firing or gas, cost less than bottled fruit from the grocer, and (2) the bottles need but rarely be broken and may be used year after year, the yearly loss being perhaps one in a dozen bottles—even the rubbers may be used more than one year quite safely if properly preserved.

Information on the preservation of fruit is given in three leaflets issued by the Board: Leaflet No. 250 (*Fruit Bottling for Small Holders*), Special Leaflet No. 5 (*Fruit Preserving for Small Market Growers and for Housewives*), and Special Leaflet No. 31 (*The Making of Fruit Pulp*). Any of these leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. The letter or postcard of application need not be stamped.

Notes on Feeding Stuffs in July: *From the Animal Nutrition Institute, Cambridge University.*

Prices of Feeding Stuffs.—With the exception of decorticated cotton cake, soya bean cake, and barley, which are slightly dearer, there is a general fall in the prices of feeding stuffs this month. In the case of cakes the fall is slight—$1\frac{1}{4}d.$ per unit or less. It is much greater in the case of most of the starchy foods, such as wheat offals, maize (and its by-products), and oats, and amounts in some cases to as much as $5d.$ per unit.

The prices per ton and per food unit are given in the tables, which are on the same lines as last month.

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of June.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soya Bean Cake	122·3	12	5	0		—		12	2	6		—	
Decorticated Cotton Cake	126·3	13	10	0	13	0	0	12	10	0		—	
Indian Linseed Cake ..	123·1	*13	0	0	12	10	0		—			—	
English Linseed Cake ..	120·1	13	0	0	13	15	0	12	7	6	13	2	6
Bombay Cotton Cake ..	65·3	9	15	0	9	17	6	9	5	0	9	17	6
Egyptian Cotton Cake ..	71·9	10	0	0	10	10	0	10	0	0	10	7	6
Coconut Cake	102·6	10	7	6	9	15	0		—			—	
Palm-kernel Cake ..	90·5	7	0	0	7	17	6	8	10	0	8	15	0
Ground-nut Cake ..	145·2	†12	5	0	10	10	0	11	10	0	11	12	6
English Beans	99·5	11	7	5	13	1	4	12	0	0	11	15	9
Chinese Beans	101·2	11	18	0	12	12	0		—			—	
English Maple Peas ..	97·2	12	13	4		—		13	6	8		—	
English Dun Peas ..	97·2	12	0	0		—		12	8	11		—	
Calcutta White Peas ..	97·5	15	2	3		—			—			—	
American Maize	93·8	10	5	4	10	1	7		—			—	
Argentine Maize	94·2	9	11	4	10	13	9	10	7	8	10	19	4
Maize Meal	86·5	10	0	0	11	5	0	11	17	6	11	10	0
Maize Gluten Feed ..	121·6	10	10	0		—			—		11	10	0
Maize Germ Meal ..	99·2	10	5	0	11	5	0		—		11	5	0
English Feeding Barley ..	83·0	14	11	2		—		13	11	7		—	
English Oats	75·4	11	6	8	12	4	9	11	6	8	11	13	4
Argentine Oats	75·4	11	1	1		—			—		11	1	0
Malt Culms	69·9	7	10	0	8	0	0	6	5	0	8	0	0
Brewers' Grains (dried) ..	84·5	8	15	0		—		7	0	0	9	0	0
Brewers' Grains (wet) ..	21·1	1	1	0		—		1	10	0		—	
Distillers' Grains (English)	101·2	8	18	9	8	0	0		—		10	0	0
Distillers' Grains (French)	101·2	8	16	3		—			—			—	
Egyptian Rice Meal ..	78·7	10	0	0		—		10	0	0		—	
Burmese Rice Meal ..	78·7	9	0	0	9	10	0		—		10	7	6
Wheat Middlings (coarse)	93·4	8	3	9		—		8	15	0	10	10	0
Wheat Sharps	86·3	8	7	6	8	12	6	10	5	0	9	10	0
Wheat Pollards	81·9		—		6	15	0		—			—	
Wheat Bran	77·5	5	12	6	6	5	0	5	15	0	6	10	0
Wheat Bran (broad) ..	79·9	6	12	6	6	7	6	6	15	0	7	0	0
Feeding Treacle	60·0	‡14	0	0	13	12	6		—			—	
Linseed	153·5	20	0	0	§22	0	0	20	12	0	19	10	5
Linseed Oil	250·0	34	0	0	‖42	0	0	33	10	0	49	15	7
Egyptian Cotton Seed ..	108·6	14	0	0		—			—			—	
Bombay Cotton Seed ..	99·6		—			—			—			—	
Cotton Seed Oil	250·0	44	0	0	50	0	0	43	10	0		—	

* 2nd grade (London) £12 10*s.* 0*d.* per ton.
† 2nd grade (London) £11 7*s.* 6*d.* per ton.
‡ 2nd grade (London) £10 10*s.* 0*d.* per ton.
§ Cleaned.
‖ In barrels.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	0	American maize.. ..	2	2¼
Wheat bran	1	5½	English beans	2	3½
Palm-kernel cake ..	1	6¾	Burmese rice meal ..	2	3½
Wheat bran (broad) ..	1	8	Maize meal	2	3¾
Ground nut cake ..	1	8¼	Chinese beans	2	4¼
Maize gluten feed ..	1	8¾	English dun peas ..	2	5½
Distillers' grains (French)	1	9	Egyptian rice meal ..	2	6½
Wheat middlings ..	1	9	Egyptian cotton seed ..	2	7
Distillers' grains (English)	1	9¼	English maple peas ..	2	7¼
Wheat sharps	1	11¼	Linseed	2	7¼
Soya bean cake	2	0	Linseed oil	2	8¾
Argentine maize ..	2	0¼	Egyptian cotton cake ..	2	9½
Coconut cake	2	0¼	Argentine oats	2	11¼
Maize germ meal ..	2	0¾	Bombay cotton cake ..	2	11¾
Brewers' grains (dried) ..	2	1	English oats	3	0
Indian linseed cake ..	2	1¼	Calcutta white peas ..	3	1¼
Malt culms	2	1¾	English Feeding barley	3	6
Decorticated cotton cake	2	1¾	Cotton seed oil	3	6¼
English linseed cake ..	2	2	Feeding treacle	4	8

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	5¼	English linseed cake ..	2	3½
Distillers' grains (English)	1	7	Malt culms	2	3½
Wheat bran (broad) ..	1	7¼	Burmese rice meal ..	2	5
Wheat bran	1	7½	Chinese beans	2	5¾
Wheat pollards	1	7¾	Maize meal	2	7¼
Palm-kernel cake ..	1	9	English beans	2	7½
Coconut cake	1	10¾	Linseed	2	10½
Wheat sharps	2	0	Egyptian cotton cake ..	2	11
Indian linseed cake ..	2	0¼	Bombay cotton cake ..	3	0¼
Decorticated cotton cake	2	0¾	English oats	3	3
American maize.. ..	2	1¾	Linseed oil	3	4½
Argentine maize ..	2	3¼	Cotton seed oil	4	0
Maize germ meal ..	2	3¼	Feeding treacle	4	6½

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	English beans	2	5
Wheat bran	1	5¾	Egyptian rice meal ..	2	6½
Ground nut cake ..	1	7	English dun peas ..	2	6¾
Brewers' grains (dried) ..	1	8	Linseed oil	2	8¼
Wheat bran (broad) ..	1	8¼	Linseed	2	8¼
Malt culms	1	9½	English maple peas ..	2	9
Wheat middlings ..	1	10¼	Maize meal	2	9
Palm-kernel cake ..	1	10½	Egyptian cotton cake ..	2	9¼
Decorticated cotton cake	1	11¾	Bombay cotton cake ..	2	10
Soya bean cake	1	11¾	English oats	3	0
English linseed cake ..	2	0¾	English feeding barley ..	3	3¼
Argentine maize	2	2½	Cotton seed oil	3	5¾
Wheat sharps	2	4¾			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	7¼	Malt culms	2	3½
Wheat bran	1	8¼	Argentine maize ..	2	4
Wheat bran (broad) ..	1	9	English beans	2	4½
Maize gluten feed ..	1	10¾	Linseed	2	6½
Palm-kernel cake ..	1	11¼	Burmese rice meal ..	2	7¾
Distillers' grains (English)	1	11¾	Maize meal	2	8
Brewers' grains (dried) ..	2	1¾	Egyptian cotton cake ..	2	10½
English linseed cake ..	2	2¼	Argentine oats	2	11¼
Wheat sharps	2	2½	Bombay cotton cake ..	3	0¼
Wheat middlings ..	2	3	English oats	3	1¼
Maize germ meal ..	2	3¼	Linseed oil	3	11¾

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	2½	Argentine maize ..	2	2½
Wheat bran	1	6¾	English beans	2	5
Ground nut cake ..	1	7	Chinese beans	2	5
Wheat pollards	1	7¾	Burmese rice meal ..	2	5½
Wheat bran (broad) ..	1	8	English dun peas ..	2	6
Distillers' grains (French)	1	9	Egyptian rice meal ..	2	6½
Palm-kernel cake ..	1	9¼	Egyptian cotton seed ..	2	7
Distillers' grains (English)	1	9¼	Maize meal	2	7
Maize gluten feed ..	1	9¾	English maple peas ..	2	8
Coconut cake	1	11½	Linseed	2	8¼
Brewers' grains (dried) ..	1	11½	Egyptian cotton cake ..	2	10
Wheat middlings ..	1	11½	Argentine oats	2	11¼
Soya bean cake	1	11¾	Bombay cotton cake ..	2	11½
Indian linseed cake ..	2	0¾	English oats	3	1
Decorticated cotton cake	2	0¾	Calcutta white peas ..	3	1¼
Malt culms	2	1½	Linseed oil	3	2¼
Wheat sharps	2	1¾	English feeding barley ..	3	4½
English linseed cake ..	2	2	Cotton seed oil	3	8
American maize	2	2	Feeding treacle	4	7¼
Maize germ meal ..	2	2½			

The following rations are suggested:—

Horses.—Farmers who wish to keep up the condition of their horses, in view of the great accumulation of work which will result from the delayed hay time, will find the ration recommended last month suitable and economical. The ration was 3 lb. of maize gluten feed and 4 lb. of bran, which is about equivalent in food value to 8 lb. of oats. As the stock of gluten feed becomes used up, the ration might be changed to 7 lb. of bran and 2 lb. of crushed beans.

Cows.—The deepest milkers should get some dry food in addition to grass. At present prices from 3 to 6 lb. per head per day of a mixture of linseed cake and bran is a suitable and economical ration.

Young Stock which it is desired to push on should get 2 lb. per head per day of a mixture of linseed cake and bran.

Lambs intended for early mutton will do well on the same mixture. If they are on rape or summer cabbage ground-nut cake may be added to the mixture.

Pigs.—At present prices it is extravagant to feed pigs on barley meal. It is much more economical to use a mixture of sharps, or similar wheat offal, and linseed cake. Seven parts of the offal should be made into slop in the ordinary way, and one part of linseed cake, ground fine, stirred into the slop just before use. At present prices barley meal costs about £14 per ton, and a mixture of sharps and linseed cake in the proportions stated costs only about £9 10*s.* per ton. The saving is, therefore, very considerable.

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0.8	45.2	6.3	21.1	77.5	102
Soya bean cake	1 : 1.1	34.0	6.5	21.0	66.7	88
Decort. cotton cake ..	1 : 1.2	34.0	8.5	20.0	71.0	93
Linseed cake, Indian ..	1 : 1.9	27.8	9.3	30.1	77.1	101
Linseed cake, English ..	1 : 2.0	26.7	9.3	30.1	76.0	100
Cotton cake, Egyptian ..	1 : 2.1	15.5	5.3	20.0	40.0	53
Cotton cake, Bombay ..	1 : 2.5	13.1	4.4	21.5	37.6	49
Distillers' grains, English, " " French	1 : 2.9	18.7	10.2	29.0	57.3	75
Maize gluten feed	1 : 3.0	20.4	8.8	48.4	87.4	115
Brewers' grains, dried ..	1 : 3.5	14.1	6.6	32.7	50.3	66
Coconut cake	1 : 3.8	16.3	8.2	41.4	76.5	101
Palm-nut kernel cake ..	1 : 4.6	12.5	7.7	39.0	69.5	90
Linseed	1 : 5.9	18.1	34.7	20.1	119.2	157
Bombay cotton seed ..	1 : 6.6	11.0	16.8	30.1	77.5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8.5	9.0	6.2	61.2	81.0	107
Rice meal	1 : 9.4	6.8	10.2	38.2	68.4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white ..	1 : 2.1	23.3	1.1	45.9	66.9	88
Beans, English	1 : 2.6	19.3	1.2	48.2	67.0	88
Beans, Chinese	1 : 2.6	19.6	1.7	47.9	67.0	88
Peas, English maple ..	1 : 3.1	17.0	1.0	50.0	70.0	92
Brewers' grains, wet ..	1 : 3.5	3.5	1.5	8.6	12.7	17
Malt culms	1 : 3.6	11.4	1.1	38.6	38.7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8.0	8.0	2.1	57.8	67.9	89
Oats, English	1 : 8.0	7.2	4.0	47.4	59.7	79
Oats, Argentine	1 : 8.0	7.2	4.0	47.4	59.7	79
Maize, American	1 : 11.5	6.7	4.5	65.8	81.0	107
Maize Argentine	1 : 11.3	6.8	4.5	65.8	83.5	110
Maize meal	1 : 13.0	5.5	3.5	63.9	77.8	102
Wheat middlings	1 : 5.3	12.0	3.0	56.0	59.1	78
Wheat sharps	1 : 5.0	12.0	4.0	50.0	58.4	77
Wheat pollards	1 : 5.3	11.6	3.5	53.0	54.1	71
Wheat bran	1 : 4.7	11.3	3.0	45.0	49.7	65
Wheat bran, broad ..	1 : 4.7	11.3	3.0	45.4	48.1	63

THE question of labour remains the chief problem of the farmer, and in this connection some striking passages may be quoted from a speech made by Lord Selborne, then President of the Board of Agriculture and Fisheries, to a large and representative gathering of farmers at Lincoln on 9th June. Referring to the test whether the British Empire and her Allies can endure to the end, Lord Selborne remarked that he did not think it untrue or boastful to say that "if Providence has endowed us with one quality more than another, it is the power of endurance.

"That does not apply only to you as free men holding in your hands the fate of the Government of your country; it does not apply to you only as soldiers, but also as farmers, concerned with the maintenance of the status of agriculture.

"The war is not only being fought by Germany on her organisation as a military power; it has been deliberately fought by Germany on an agricultural organisation. Startling as that may be, it is nevertheless true. If Germany had made no more progress in agriculture in the last 20 years than we have in England, she would have been on her knees suing for peace 12 months ago. A remarkable paper, which I am shortly going to present to Parliament, and which has been drawn up by Professor Middleton, one of my colleagues at the Board of Agriculture, shows what the German agricultural policy has been, and what its effects are on this war. I commend that to you. It will be worth reading. How different our position here. We had no agricultural policy. Most of the people of this country, or a great many of them, had forgotten that the cultivation of the soil mattered at all. Their food came like the milk—like the water laid on to the tap. This dependence on foreign supply has been a source of great weakness to us in this war. It is easy to imagine circumstances where it could have caused a hole in our armour where we might have received a mortal wound. If we had not been importing all this foreign foodstuff we should have had no difficulty practically in matters of foreign exchange. But no change of policy was possible in the midst of the war, and we had to make the best of the resources that existed. Every shipload of food which comes over here means a shipload of munitions or so much less trade by which we might have supported the financing of the war.

"It is the duty of every single man or woman to-day to increase the food production of England.

"There is a crucial test coming on. You have the hay harvest

coming—and I believe and hope a bumper crop—and you have the corn harvest to follow. How are you going to get that in? Many may see their way clear, but not all. There must be many farmers in different parts of the country who are puzzled how they are going to tackle their job. I came to an arrangement with Lord Kitchener, almost the last piece of mutual business we did together, as to the conditions and terms under which the Army would help you to get in your harvest. We have profited by experience, and I think you will find the regulations simpler and quicker than they were last year. This year we have placed the whole responsibility on the War Agricultural Committees, through the District Committees. We have told them what the arrangements are, and left it to them to carry out. But don't leave it to the last moment.

"Oh, you farmers, you are so difficult to help! You don't read the circulars sent you, and you don't even reply to the inquiries sent out. My Department sent out 3,000 forms to farmers on the matter of military labour, asking them to let me know what labour they would want and where, and I have had only 52 replies. How can the Board of Agriculture help in those circumstances. The other 2,950 will wait till they want to cut the hay, and they will blame the Board of Agriculture. It is no joke. It is tragic in a time like this. You have something more on your shoulders than your own business to-day. You are no longer individual farmers, making your own fortunes or losing them. You are trustees on your own land to do your best for England. You have your duty quite as clear and as definite as the captain of a cruiser or the colonel of a battalion. England has a claim on you farmers, men and women of every class, as clear as she has on our sons and husbands to go and serve in the trenches. You are proud of the boast that there is no more patriotic class than the farmers. It is true; but it is also true that you have very little imagination, and you have not in the least extent realised how important you are in this time of war, and how much you can do for England on your farms, or how badly England would suffer if you don't do your best.

"There is holiday labour and the National Volunteer movement. You can appeal to them, and you have not done your duty or played your part if you have not exhausted every possible source of supply. If the harvest is not saved the fault will be before history on you farmers and the organisation of the county, because the thing can be done in this way, and, with the fortune of England at stake in this war, there is nothing that is impossible.

"The most important source of new labour that is open to you is the women. . . . Although there is no county in England to-day, and hardly a parish, where women are not working on the land, and although there has not been one single case where a farmer once having employed women wants to get rid of them, there are, I am told, still farmers who say that they would rather their land went out of cultivation than have a woman upon the place. I would appeal to all farmers to take such a brother farmer and argue with him in a firm but brotherly fashion, show him the egregious, the ineffable folly of such an attitude, and show him he has no right in this moment of real national need to allow his prejudices to govern his conscience.

"Now I want to appeal to the women. I only ask them to come on to the land for one reason, and for one reason only—because England needs them to-day. I appeal to them solely and exclusively on the ground of patriotism. England needs them just as much hoeing the farmer's corn or his roots as in making munitions or going into the hospitals."

Desiring to add a word to labourers on the farm, Lord Selborne said: "Their duty is as clear as the farmer's or that of the women. They should make it a point of honour to give the farmer better work than they have given before, to work long hours, and try to make up to the farmer the loss of their comrades who have gone to the Front. All of you—landowners, farmers, labourers, or women—have, every single one of you, got your part to play in this war, and it is only if we recognise that fact that we can be sure of that victory we are looking for."

Marketing of Farm Produce in the United States by Parcel Post.

1. With the object of bringing the farmer into direct contact with the consumer the Post Office Department of the United States has instituted a propagandist movement to increase the amount of marketing of farm produce carried on through the medium of the parcel post. Thirty-five cities have been selected, the postmasters of which circularise farmers within a radius of 150 miles and draw up lists of names and addresses of those who offer produce (under the heading of the articles for sale) and distribute these lists among possible customers; and in some cases lists of customers who wish to buy are distributed to farmers.

Besides the above method, other means of establishing contact for the purposes of parcel post marketing are (1) personal acquaintance, (2) through the acquaintance of a third person, (3) advertisement in selected papers, and (4) personal canvass.

The parcel post charges vary with the distance: thus, local parcel post rates are $2\frac{1}{2}d.$ for the first lb. and an additional $\frac{1}{2}d.$ for every additional 2 lb.; parcel post rates within a distance of roughly 150 miles are $2\frac{1}{2}d.$ for the first lb. and an additional $\frac{1}{2}d.$ for every additional lb.; the weight limit in both cases is 50 lb.; the girth of the parcel, added to the length, must not exceed 84 in.

Poultry, butter, eggs, fruit and vegetables have been found suitable for marketing in this manner, and, in general, the highest qualities of these products (especially standard and fancy produce). The United States Department of Agriculture has issued bulletins to farmers giving instructions as to the grading and packing of produce marketed in this way (Farmers' Bull No. 594, *Shipping Eggs by Parcel Post*; No. 703, *Suggestions for Parcel Post Marketing*; and a bulletin is being prepared on *Shipping Butter by Parcel Post*).

According to a statement by an official of the Post Office the system has been so successful that extra vehicles have had to be employed on the parcel post work. The plan seems to have given best results among the middle-class and well-to-do consumers, who pay ready money and for whom price is not almost the sole desideratum; the working-classes, who are accustomed to credit and to pay on receipt of wages, have not taken up the scheme.

The criticisms levelled against this Post Office scheme are that the postmasters are bound to discriminate between customers owing to the impossibility of circularising every possible customer; that the postmasters have further discriminated between farmers, as they have used their judgment as to who are, and who are not, reliable farmers; and that the system assumes that the goods in the list are continuously on offer till the publication of the next list—an assumption that may lead to disappointment among customers, much correspondence and waste of money in stamps, and much cashing of money-orders taking place without any business being done.

2. A plan has been put forward by Mr. David Lubin, the American delegate to the International Agricultural Institute, for remodelling the system of marketing by parcel post, a plan which makes use of some of the methods in vogue in the large businesses of the United States which may have large sales by

parcels post amounting annually to about 20 million pounds sterling in value. The scheme was outlined at three conferences at Washington and Chicago in November and December, 1915, and seems to have stood criticism well; it is part of a very much larger plan for marketing the total produce of the farm by means of the establishment of a National Chamber of Agriculture.

Under the second plan the farmer would register his name and address at the Post Office and be given a number, together with cards of various colours (each colour representing a certain kind of farm product) his number being stamped on these cards; each would be taken to represent one "unit" *e.g.*, 1 white card = 1 doz. eggs, 1 pink card = 1 chicken), and the farmer would post to the Post Office the cards requisite to cover the amount of produce he wishes to dispose of in this way, stating the price for each "unit" on each card; if he wished to withdraw any produce from offer he would need to withdraw the corresponding cards.

Next, the postmasters would provide a separate room fitted with racks of different colours to correspond with the cards, each rack being fitted with numbered grooves for the different farmers. On receipt, the cards from farmers would be sorted into their respective racks. The prospective customer would choose the products required by looking through the racks. Payment would be made by means of a "purchasing" book, bought by the customers beforehand from the Post Office. Sufficient coupons would be taken from the purchasing book to cover the cost of produce bought and be attached to the various farmers' cards by the Post Office clerk. At the end of the day all the cards for one farmer would be enclosed in the same envelope and posted.

On receipt of the cards and coupons the farmer would dispatch the produce by parcel post (preferably in collapsible boxes or baskets), keeping the coupons till a convenient time, when they could be cashed at the Post Office. The boxes would have the farmer's number (or address) affixed and be returned through the Post Office.

It is thought that the above scheme could be given a more than local character if the farmer were allowed to send cards to a number of post offices; and, by the use of the telephone or otherwise, consumers' requirements could be transferred from one postal station to another.

Further, it is not an essential that the goods should be dispatched by parcel post; an association of consumers could have produce dispatched in bulk by rail.

The point on which the success of the scheme hinges is as to whether the saving realised by the elimination of middlemen would cover the parcel post charges, recoup the farmer for extra trouble, and allow the produce to be sold to the consumer at a slightly lower price than that charged for produce sold by ordinary methods. It is thought that, with increasing volume of business, it would be possible to reduce postal rates.

It is held that the scheme would enable reliable farmers to build up a reputation; that customers would get certain classes of perishable produce in a much fresher condition; and that an increase in the number of customers would probably mean greater security for the farmer.

Lastly, the history of the large parcel post order businesses of the United States has shown that when people realise the saving to be effected a great many will be willing to take the trouble necessary to make the saving, *e.g.*, ordering in advance and laying out money in advance in purchase books.

The Employment of Ex-Service Men in Agriculture.

THE Committee which was appointed by the President of the Board of Agriculture and Fisheries on 15th July, 1915, to "consider and report what steps can be taken to promote the settlement and employment on the land in England and Wales of sailors and soldiers, whether disabled or otherwise, on discharge from the Navy or Army" have presented Part II. of their Final Report [Cd. 8277, price 4*d.*] dealing with the employment (as distinct from settlement*) of ex-service men in agriculture.

The great majority of ex-service men will have, in the first instance, to gain their living by employment as agricultural labourers (and not immediately as small holders) so that employment is a much larger problem than settlement. In the Committee's view the policy of settlement is to be regarded as a permanent system for providing an agricultural "ladder" by which the industrious and enterprising labourer can obtain a small holding as the result of his industry and intelligence. The question of "employment" is dealt with under the three heads—(1) The shortage of agricultural labour which will exist at the end of the war; (2) How to meet any serious amount of unemployment which may occur on demobilisation; (3) Employment occasioned by an extension and development of the agricultural industry.

The Shortage of Agricultural Labour which will exist at the end of the War.—The Committee estimate that 320,000 men have left the land since the beginning of the war, and to this figure will have to be added the number leaving between now and the end of the war; the number who will not go back to the land is estimated at 25 per cent. of the enlistments, or at least 80,000.

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* The Report on "Settlement" was summarised in the *Journal* for February, 1916, p. 1166. The Committee also issued an Interim Report, a summary of which will be found in this *Journal* for November, 1915, p. 813.

From an examination of the means to be adopted to meet this serious shortage the Committee are forced to the conclusion that, unless the agricultural production and population are to be further reduced, a considerable number of ex-service men who were not employed in farm work on the outbreak of war will have to be brought into English agriculture; thus, the present employment of children cannot be continued permanently, a great number of women will discontinue their agricultural work on the declaration of peace, and, lastly, although the demand for agricultural machinery will increase at the end of the war, it is very questionable whether such machinery as motor tractors and motor ploughs saves *man* labour to as great an extent as is often suggested.

Referring to the possibility of the ex-service man settling in the Dominions, or in foreign countries, the Committee think a great deal might be done, not only to bring home to him the comparative advantages of life in a more settled country, but to improve the conditions that have hitherto prevailed.

The question of *wages* was fully considered by the Committee. On this point, however, they were divided, four members being in favour of the establishment of a minimum wage, as they considered that, if prices of farm produce fell after the war, agricultural wages would fall also, and thus prevent the influx of labour into agriculture; while five members thought that conditions after the war would be such that the present high rates of agricultural wages would be maintained. The adoption of schemes of profit-sharing, of which an example was given in this *Journal* for June, 1912, p. 206, is recommended by the Committee as possibly having the effect of retaining agricultural labourers on the land, of encouraging thrift, and of improving the relationship between employer and employed.

Improvement is necessary in the second place in *housing* conditions. Just before the war, however, the Housing and Town Planning Act was beginning to effect substantial improvements in rural housing. Further, it is recommended that as soon as practicable the Act passed in 1914, which authorised the Board of Agriculture to advance large loans to local authorities and public utility societies in agricultural districts for the purpose of erecting cottages, should be made operative, local authorities and public utility societies being encouraged to build in the districts in which cottages are most needed; such provision of cottages would also largely solve the difficulties attaching to the present system of "tied" cottages. Approval is given to the suggestion that war memorials might often take the shape of groups of cottages for ex-service men, the cottages to be vested in some public authority. It is recommended that an economic rent be charged for any new cottages provided, the present system of nominal rents keeping agricultural wages low and benefiting others besides agricultural labourers.

In the third place more opportunities for *recreation and self improvement* are wanted, and more prospect of advancement in life. These may be summarised as follows: a good garden, opportunity of renting an allotment, proximity of a good school with a rural bias, brighter village life (club room, library, recreation grounds), and improved organisation of co-operation and agricultural credit, enabling the aspiring labourer to ascend the "ladder" to a small holding.

For various reasons, *e.g.*, the demand for labour by farmers, the need for inspecting farmers if training premiums were given, and the limited extent of the farms owned by public authorities, the Committee do not

consider it necessary or expedient to arrange for the training of inexperienced men before they obtain agricultural employment. It is recommended, however, that opportunities should be provided in every county, after the war, for men employed in agriculture to obtain instruction in manual farm processes, such as ploughing, sheep-shearing, hedging and ditching, milking, draining and rough carpentry, and it is thought that the Board should make special grants to local education authorities for this purpose.

In the interests both of the farmer and the ex-service men, the development of the Labour Exchange in rural districts is recommended; new Labour Exchange branches should, it is stated, be opened in market towns and placed under officials acquainted with agriculture, or else new machinery established under the Board of Agriculture; the officials should visit the market towns on market days, ascertain the rates of wages offered and paid for different classes of agricultural labour, the seasonal earnings, and extra allowances, and the cost and availability of housing accommodation in the neighbourhood; full publicity should be given to the standard rates of pay and other particulars week by week in the local papers, and lists of farmers requiring men should be drawn up by the Labour Exchange and full information as to the rates of wages offered should be available for inspection by applicants.

To assist ex-service men to obtain employment it is recommended that the Territorial Association of each county should address an appeal to landowners and farmers asking them to give preference to discharged sailors and soldiers over other applicants.

With regard to allotments for ex-service men who return to the towns, the Committee state that by the provision of such land at a reasonable price, within a short distance of every centre of population, many families would obtain a substantial addition to their food supply, and a far larger number of persons would be interested in the prosperity of agriculture; the need for suitable buildings and qualified instructors is mentioned.

It is suggested that the Committee's proposals, together with information as to the factors which make rural life more attractive and economical than town life, should be brought to the notice of soldiers between the cessation of hostilities and the time when men are granted furlough previous to being discharged.

How to meet any serious amount of Unemployment which may occur on Demobilisation.—The Committee state that it is quite possible, and even consistent with the theory of the shortage of agricultural labour, that the demobilisation of the forces will result in a serious condition of unemployment in the labour market generally. It is considered important, therefore, that among the schemes of remunerative works of improvement which will doubtless be prepared, the State should include reclamation* and afforestation.

It appears possible to reclaim considerable areas of slob land on the East Coast and of bog land in Wales at a cost which would be reasonable in proportion to the ultimate value of the land to be gained for cultivation. If the experiments now being carried on by the Development Commission on heath land in Norfolk prove successful, the Committee state that some of these areas might also be taken in hand with a view to their improvement, and to the employment of ex-service men on the land.

* A Memorandum on the Reclamation of Waste Lands, by Mr. A. D. Hall, is published as an Appendix to the Report.

With regard to the danger of dependence on imported timber, and the consequent necessity for afforestation schemes, the Committee think that the State itself might undertake schemes, or might make loans to landowners for the purpose, or might advance money to the Corporations of some of our large cities to enable them to plant their water catchment areas.

The Committee state that the important thing is to have the above schemes ready and all legal and other obstacles removable at short notice; further powers to acquire and develop land will have to be vested by law in some Government Department, preferably the Board of Agriculture.

Employment occasioned by an Extension and Development of the Agricultural Industry.—On the grounds of physique and health, the desirability of increasing our home production of food, and national security generally, the Committee are convinced that advantage should be taken of the impending release of many thousands of able-bodied and energetic young men to secure a great reinforcement of our farm workers and rural population over and above merely supplying the deficiency caused by the war.

It being agreed that the only means by which a substantial increase in the home production of food can be obtained is by bringing under the plough a large area of land now devoted to pasture, the Committee indicate the following measures as being most worthy of consideration in order to en surestability of prices for arable produce :—

1. A guarantee by the State of a minimum price for home-grown wheat for a period sufficient to give confidence to the farmers.
2. An offer by the State of a bonus for each acre of permanent grass land brought under the plough and kept in a proper state of cultivation.
3. The imposition of import duties on agricultural produce sufficient to give the protection that is necessary to the farmer.

Besides an increase in the tillage area there would be necessary an extension of the provision of advice for farmers, agricultural research and education, improved facilities for transport, better business methods, the development of co-operative organisation, the use of modern agricultural machinery, the introduction into agriculture of a large amount of new capital, and the establishment of new agricultural industries (beet sugar, industrial alcohol and starch, tobacco, etc.).

An appended note by the Chairman of the Committee emphasises the magnitude and urgency of the opportunity now offered for combining the development of British agriculture with the employment of ex-service men, and urges that no time should be lost in introducing the necessary legislation to give effect to the policy (if approved) of bringing back to the land as many ex-service men as can be permanently employed there under suitable conditions.

A Minority Report is presented by three members who are of opinion that the Majority Report fails to find a solution to the problem of making the conditions of life good enough to attract the ex-service man, and who insist that the policy of getting many more men engaged in agriculture than was the case before the war is essential for the national welfare and must be carried out in time, as they assume that demobilisation will be rapid; they refuse to regard necessary measures as controversial legislation, but as emergency legislation; they emphasise the need for minimum wage legislation and the establishment of district wage boards.

As regards the measures calculated to give the farmer, especially the arable farmer, sufficient security and stability of prices for his produce to enable him to pay an adequate wage, and as regards the measures other than the minimum wage necessary to attract the ex-service men to the land, the Minority are, on the whole, in agreement with the Majority, insistence, however, throughout, being laid on the element of time.

In connection with the importance of the element of time, the following remarks are made in the Minority Report :—

"If the men are to be retained in this country, it is plain that the nation must be in a position to make them a 'firm' offer at the time when they will have to make up their minds. . . . .

"In our view it is impossible to exaggerate the importance of this fundamental factor of the problem. Everything hinges on it. It means, in our opinion, that the whole policy of the Government must not only be thought out at once, but that most of it must be passed through Parliament before the end of the War. If that be done the delay inevitably incidental to employing large numbers of men in excess of the number employed in farming before the War need not be fatal. By means of temporary expedients, such as reclamation schemes, or the need of farmers to take on extra hands for breaking up grass land, or definite promises by farmers of employment at deferred dates, the men may probably be persuaded to stay in England. But they will not be persuaded unless they know exactly what sort of a life they will have to look forward to when they do get their employment.

"We, of course, realise that the proposals we make are drastic; that to carry them out involves big changes in the whole outlook of the country towards agriculture; that it means a new agricultural policy; and that we ask for all or much of this to be done during the War. That is true, but the opportunity, we repeat, is unique; it will never recur; and the time which will be available for seizing it will be short, just as long as it takes to discharge the men at the end of the War. It is this exigency of the occasion which necessitates such rapidity of action."

The following summary of their views concludes the Minority Report :—

(1) That it is essential for the national welfare and for the future development of British agriculture to bring back to the land as many as possible of the agricultural labourers who have left it, and to attract to the same occupation a substantial number of ex-service men who have not hitherto had any agricultural experience.

(2) That we shall not achieve either of these objects unless important changes are made in the pre-war conditions both of the farming industry and of the agricultural labourer's life on the land.

(3) That the measures necessary to secure these changes should be introduced and passed into law at the earliest possible moment, so as to retain in this country the ex-service men who desire occupation on the land.

(4) That if advantage is not taken of the impending release of millions of able-bodied and energetic young men from the forces and munition factories to secure a great reinforcement of our farm workers and rural population, a unique opportunity of increasing the Nation's strength both for peace

Serum Treatment for Swine Fever.

THE Annual Report of the Board's Chief Veterinary Officer for 1915 [Wyman & Sons, 1*d.*] has been reduced in scope so that it embraces little more than is required to preserve continuity of the series of annual reports on diseases of animals. Useful information, however, is given as to the course of foot-and-mouth disease, swine fever, swine erysipelas, tuberculosis, glanders, anthrax, sheep scab and rabies in 1915.

The serum treatment for swine fever, with the results so far obtained, is, perhaps, of special interest, and the following account has been taken from the Report :—

"Commencing on the 26th September, veterinary inspectors on visiting outbreaks of swine fever were instructed to offer to treat with serum all pigs on the premises which were apparently healthy at the time. Owners were also given the option of having their ailing swine slaughtered with compensation or keeping them to mix with the healthy pigs after the latter had received serum. The object of the mixing was to give the healthy pigs a mild attack of the disease while under the influence of serum for the purpose of endowing them with a lasting immunity.

The results of the treatment in practice are available only for those outbreaks which occurred in the last quarter of 1915. It may be explained that, if pigs remain alive on infected premises, the outbreak cannot be considered closed for at least three months, and therefore the full results in relation to some outbreaks which began in December did not become available until April, 1916.

The question is somewhat involved owing to :—

(*a*) The changes in procedure or policy not having taken place at the beginning of any one year ;

(*b*) Two results having to be brought out, viz., the results of serum treatment as a preventive, and its results as an applied policy.

Both the matters referred to in (*b*) are intimately connected, and must be discussed together, but the difference may be summed up shortly, as indicated in the Chief Veterinary Officer's Report to the Swine Fever Committee, by saying that a method in itself excellent may lose a greater or lesser amount of its value, owing to the conditions under which it has to be applied in practice. The latter is what is referred to by serum treatment as a policy.

To follow the question in its various bearings it is necessary to go back to 1913 and 1914, and explain that the loss of pig life through swine fever has been due to direct and indirect causes made up as follows : —

(*a*) Pigs slaughtered by the Board for diagnosis ; usually ailing pigs ;

(*b*) Pigs slaughtered by the Board in the expectation that their removal by slaughter would curtail the duration of outbreaks, and prevent wider dissemination of infection ; these were usually healthy pigs in various stages of maturity, from unweaned to fat, sows, and boars.

(*c*) Pigs which died of swine fever, or were killed as diseased and useless by their owners.

(*d*) Pigs slaughtered by the Board, because they were distinctly ailing on the day or days the veterinary inspector first visited the outbreak. This did not operate until the last quarter in 1914.

In the year 1913 there were 2,573 outbreaks. The number of pigs on the infected premises was 56,508. The total number which died or were slaughtered was 41,811, 74 per cent. of the whole. The number slaughtered under (*b*) was 32,034.

It may be said that serum treatment as a policy aims, *inter alia*, at preserving this large number of pigs (that means in many cases only until fit for slaughter).

The year 1914 was a transition year, that is to say, the same procedure as in 1913 operated during the first three quarters, but in the fourth quarter it was modified. The slaughter under (*b*) was practically given up in the fourth quarter, and the slaughter of distinctly ailing pigs, as stated in (*d*), was substituted. The number of outbreaks was 4,356. The number of pigs on the infected premises was 97,880. The number which died or were slaughtered was 59,185, 60 per cent. of the whole.

The year 1915 was also a transition year. The same modified procedure operated as in the fourth quarter of 1914, *i.e.*, the slaughter of distinctly ailing pigs by the Board was continued, but in addition in the last quarter of the year the Board put serum treatment, for those swine which were apparently healthy at the time of the veterinary inspector's visit, at the disposal of all owners of infected premises who would accept it.

In the first three quarters of the year (*i.e.*, before serum was offered) there were 3,163 outbreaks. The number of pigs on the infected premises was 72,345. The number which died or were slaughtered was 30,396, 42 per cent. of the whole.

In the fourth quarter there were 831 outbreaks which may be divided into those in which serum was used, and those in which it was not used.

In 441 outbreaks serum was not used because :—

1. No pigs remained on the premises at the time of the veterinary inspector's visit, or the owners had themselves decided to kill off all their pigs and re-stock—274 cases.
2. There were practically no suitable or healthy pigs on the premises—68 cases.
3. Owners refused—98 cases (11·9 per cent. of whole).
4. Serum was not offered—1 case.

There were 8,117 pigs on the infected premises. The number which died or were slaughtered was 4,172, 51·3 per cent. of the whole.

In 390 outbreaks serum treatment was accepted and carried out (46·9 per cent. of the whole).

There were 16,011 pigs on the infected premises. The number which died or were slaughtered was 5,705, 35·6 per cent. of the whole.

It would appear then, in so far as the results in the one completed quarter in relation to the outbreaks treated by serum is a guide, that 64·4 per cent. of the pig life was maintained as compared with 26 per cent. in 1913 before any modification as to slaughter was introduced, and 40 per cent. in 1914.

As regards the results during the same quarter on premises on which serum was not used, and when slaughter with compensation was practically restricted to ailing pigs not likely to recover, 48·7 per cent. of the pigs survived, but it has to be noted that amongst the surviving lot are included the pigs of 62 owners, who slaughtered out their pigs rather than risk keeping them. The figure is really below 48·7 per cent., but it had to be assumed, in cases where the owners slaughtered, that they were able to save their pigs' lives in the business sense.

On the premises where serum was used 64·4 per cent. of the pig life was maintained. So far with serum, as a policy, then, considerably better results were obtained than without it.

These results so far indicate that there is less wastage of pig life from swine fever than from slaughtering the stock on infected premises, and that serum treatment as a policy helps further to reduce considerably the mortality from the disease.

It appears from closer analysis of the outbreaks, however, that serum treatment in its application in practice has had to carry at least two heavy handicaps. Firstly, there is the inevitable drawback that serum is not curative, and, as differentiated from vaccination, gives only a short protection in the absence of infection, so that the treatment has to be applied by following in the wake of infection, and cannot be used successfully to get ahead of it. Consequently there is always likely to be a certain number of dead and ailing pigs before the treatment can be applied. Secondly, the slaughtering of distinctly ailing pigs with compensation at least tends to remove the incentive to report early, that is before a considerable proportion of the pigs are beyond treatment.

The analysis shows :—

1. That of the 16,011 pigs on the premises where treatment was applied, 2,334 (14·5 per cent.) were dead before opportunity arose for treatment, and at least 2,581 (16·1 per cent.) were in the grip of swine fever, total 4,915 (over 30 per cent. of infection) were beyond treatment. These must be, however, and have been in the above statement, debited to serum in valuing the treatment as a policy, on the grounds that under such circumstances defects inherent to its application in practice must be counted against any method. Whether the treatment in practice can be relieved of its handicaps to a material extent by speeding up the application of treatment in various ways is another question. It would seem possible that the Board could be put in touch with outbreaks before 30 per cent. of the pigs on an average are dead or infected.
2. That the total loss among the 16,011 pigs on serum premises was 5,705 (35·6 per cent.), but if it were permissible from a practical point of view to deduct those which died, or were slaughtered as ailing, before opportunity arose for treatment, and those which were in the grip of swine fever when treated, the loss would amount only to 5 per cent.

From this 5 per cent., however, there also falls to be deducted 2 per cent. of swine on the infected premises which, for various reasons, could not be treated, and which presumably died of swine fever."

SUMMARY OF AGRICULTURAL EXPERIMENTS.

SOILS AND MANURES.

Potash in Banana Stalks and Skins (*Jour. Soc. Chem. Ind.*, 29th April and 15th May, 1916).—Banana stalk with 91·6 per cent. of water was found to contain 1·14 per cent of potash, this being equal to 13·73 per cent. of the dry matter and 45·9 per cent. of the ash; *i.e.*, the dry matter of banana stalk is as rich as kainit in potash, and 1 ton of banana stalks would yield 25 lb. pure potash.

Banana skin with 88·2 per cent. of water was found to contain 1·05 per cent. of potash, this being 9·03 per cent. of the dry matter and 57·16 per cent. of the ash.

The average number of bunches of bananas imported into this country annually is 9,000,000; the stalks when stripped would weigh 16,071 tons and would contain 185 tons of pure potash; the skins would weigh 60,271 tons and would contain 640 tons of pure potash. The potash imported into this country in the form of banana stalks and skins is therefore equivalent to that in 6,600 tons of kainit.

Potash from Saw-mill Waste (*Jour. Ind. Engin. Chem.* [U.S.A.], February, 1916).—The conclusion drawn from this investigation is that it can be safely said that it is possible to obtain, from Douglas fir mill waste incinerators, 10 to 20 lb. of potash, calculated as K_2O, per ton of "ash" employed; and further that this potash may be obtained, along with other extractable matter, by merely leaching the ash in suitable vats with hot water for 24 hours, and that in all probability 12 hours would be as efficient.

Manurial Value of Activated Sludge (*Jour. Ind. Engin. Chem.* [U.S.A.], January, 1916).—Pot experiments with wheat to test the manurial value of activated sludge as compared with dried blood, sodium nitrate, ammonium sulphate and gluten meal supplying the same quantity of nitrogen showed the sludge to be superior to the other manures. Lettuce and radishes were planted in three garden plots. Plot I. received no treatment, Plot II. was treated with sludge (=126 lb. N. per acre), and Plot III. with extracted sludge. The increase in weight due to the sludge was 40 per cent. in the lettuce and 150 per cent. in the radishes.

Insoluble Nitrogen in Calcium Cyanamide (*Jour. für Landwirtschaft*, 33. iv.).—To test the manurial value of the insoluble nitrogen in calcium cyanamide, white mustard and oats were sown in 12 pots each. Four pots were left without nitrogen, 4 were each given 0·2 g. nitrogen in the form of sulphate of ammonia, and 4 each received 0·8 g. of nitrogen in the form of the insoluble part of calcium cyanamide. Yields of 54·9 g., 87·4 g., and 130·2 g. respectively were obtained in the case of white mustard, and 78·8 g., 120·2 g., and 190·8 g. respectively in the case of oats. It is concluded that the nitrogen of calcium cyanamide, which is insoluble in water, is by no means to be regarded as having only a small manurial value.

Effect of Sulphate of Ammonia on Soil (*Mass. Exp. Sta., Bull. No.* 165).—The aim of this experiment was to ascertain the effects of the continued use over many years of sulphate of ammonia. Several plots were treated with various solutions of ammonium sulphate. The results showed that (*a*) the absorption of ammonia by the soil increases with the increase in the concentration of ammonium sulphate

used, (*b*) the absorption of dyes by these soils is similar to the absorption of ammonia, this being evidence that the ammonia is held by physical rather than chemical forces, (*c*) ammonium-sulphate has a solvent action on the calcium in the soils, and depletes the soil of this element, (*d*) ammonium-sulphate has no solvent action on sodium or potassium in the presence of sufficient quantities of lime, but has a slight solvent action on potassium in the absence of lime, rendering more potash available for the plants, and (*e*) the use of sulphate of ammonia probably does not cause the accumulation of sulphates in the soil.

After the exhaustion of the lime by the sulphate of ammonia, salts of iron and aluminium are formed; solutions of sulphate of iron and aluminium were found by culture experiments to be injurious to seedling plants.

LIVE STOCK AND FEEDING.

Fat Lambs from Welsh Mountain Crosses (*Univ. Coll. of N. Wales. Bull.* iv., 1915).—Welsh mountain ewes were crossed in 1913–14 and 1914–15 with South Down, Wiltshire, Ryeland and Border Leicester rams. The percentage of living lambs dropped was greatest in both seasons from South Down rams (viz., 116 and 113 per cent.); the percentages of living lambs from the other crosses were, in 1913–14, Wiltshire 100, Ryeland 112, and Border Leicester 105, and in 1914–15, Wiltshire 112, Ryeland 81, and Border Leicester 100. The heaviest lambs in both years came from the Border Leicester cross; the ewes served by this ram required rather more attention than the others at lambing.

Palm-Kernel Cake for Dairy Cows (*Univ. Coll. of N. Wales, Bull.* iv., 1915).—Equal quantities (2 lb. per 10 lb. milk) of palm-kernel cake and Egyptian undec. cotton cake were compared for dairy cows, the former cake containing 10·4 per cent. of fat, 19·4 per cent. of albuminoids and 48·5 per cent. of carbohydrates. There was no striking difference in milk yields from the two cakes. The palm-kernel cake produced no ill effects on health and did not affect the flavour of the milk, and no difficulty was experienced in storing it.

Rancidity in Palm-Kernel Cake (*Jour. Agric. Sci.*, April, 1916).—Palm-kernel cake, if kept dry and cool, remains sweet for at least ten weeks. If kept moist and warm it becomes rancid in a few days. The cake contains a zymogen, which under the influence of warmth and moisture forms a lipase. The lipase then turns the oil rancid. The lipase can be destroyed by heating the moistened cake to 70° C. for a short time. If the dry cake is heated the zymogen is usually destroyed, but dry heating is not so certain to destroy it as heating when moist.

Effect of Water in Rations on the Composition of Milk (*Jour. Agric. Research, Vol. VI., No.* 4).—These experiments were conducted by the Dairy Division of the United States Bureau of Animal Industry. Four different methods for supplying rations of widely different water content were tried:—

(1) *Full Allowance of Drinking Water compared with a Limited Allowance.*—Eight cows were used, and all otherwise received the same treatment. The amount of water allowed was reduced for each cow after a transition period, and then raised again. Examination of the data obtained did not show the quantity of water drunk to have any effect upon the composition of the milk produced.

(2) *Heavy Ration of Turnips compared with Dry Roughage.*—Four cows were used, both watery and dry rations being tested with each.

All gave more milk on turnips; those fed in the order wet ration, dry ration, wet ration gave milk of a higher fat content on the wet ration, while those fed in the dry-wet-dry order gave the higher percentage of fat on the dry ration; none of the other constituents of the milk was appreciably affected.

(3) *Wet Beet Pulp compared with Dry Beet Pulp.*—The data obtained from this trial, carried out with two cows, gave negative results so far as the effect of the water in the ration upon the composition of the milk is concerned.

(4) *Green Crimson Clover compared with Cured Crimson Clover Hay.*—The green clover contained 71 per cent. of water, and the cured hay 8 per cent.; four cows were fed on each in turn for 10 days. The extra water in the green clover did not lower the fat content of the milk.

The conclusion drawn from the whole series of experiments is that rations of varying water content have no effect on the composition of the milk, there being even less variation in the other milk constituents in these trials than in the fat.

OFFICIAL NOTICES AND CIRCULARS.

Land Settlement of Ex-Service Men.

THE President of the Board of Agriculture and Fisheries desires it to be known that in the selection of settlers for the three pioneer land colonies of ex-service men, preference will be given, as between men of equal merit and qualifications, to those whose wives or sisters or daughters have, as the result of their employment on the land either before or during the War, acquired proficiency in milking or other farming operations.

Soldier Labour for Harvest.

THE following Circular Letter, dated 7th July, 1916, has been addressed by the Board to the Secretaries of the County War Agricultural Committees:—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Memorandum issued by the Army Council on the subject of the employment of soldiers on agricultural work, a copy of which was enclosed with the Board's Circular Letter of the 5th ult., A.270/C.*

The Board understand that the Army Council, provided that the General Officer Commanding-in-Chief of the Command acquiesces, will raise no objection to an arrangement under which squads of soldiers would be detached from their headquarters, supplied with tents, and allowed to camp out in districts where their services are required for the harvest, but subject to recall to their head quarters at short notice.

I am to suggest that if the arrangement is one which would be likely to be of use in your county, and if a sufficient number of soldiers can be made available, the representative appointed by your Committee in accordance with paragraph 2 of the Board's Circular Letter A.270/C, should communicate in the matter with the Military Officer appointed for the district to deal with questions relating to soldier labour.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

* This *Journal*, June, 1916, pp. 289 and 290.

THE Board of Agriculture and Fisheries desire to call the attention of farmers to the possibility of loss of, or damage to, growing crops by hostile aircraft.

Damage to Crops by Aircraft.

No liability can be accepted by the Government and no claim can be entertained in respect of damage to property by aircraft or bombardment unless the property has been insured under the Government scheme, particulars of which can be obtained at any post office or from any fire insurance company.

THE following Circular Letter, dated 23rd June, 1916, has been addressed to authorities concerned with the drainage of agricultural land :—

Drainage of Agricultural Land and Rail Transport of Coal.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to call attention to the possibility that delays may occur under present conditions in the transport of coal by rail, and I am to suggest that authorities concerned with the drainage of agricultural land should consider whether their reserve stocks of coal are sufficiently large to ensure that pumping operations will not be stopped by shortage of fuel.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

THE Meteorological Office will, as in past years, but subject to certain restrictions, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1*s*. and the cost of the telegrams, computed at 9*d*. per day. The supply of forecasts will continue until 30th September. The forecasts are drawn up each week-day at 3.30 p.m., and refer to the probable weather during the 15 hours from 6.0 a.m. to 9.0 p.m. on the next day. The addition of a "further outlook" and the issue of notifications in connection with spells of settled weather are suspended during the war.

Harvest Weather Forecasts.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W., with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period, which should not be less than 6 consecutive days, during which the forecasts are to be sent.

IN view of the importance of producing as large a supply of eggs as possible, the President of the Board of Agriculture and Fisheries desires to promote poultry-keeping among householders in both urban and rural districts. A small number of laying hens can be kept most economically as an adjunct to the ordinary household, and the extension of this practice would in course of time add appreciably to the available supply.

Poultry-keeping in Urban and Rural Districts.

Many householders are deterred from keeping poultry by the fear of protests from neighbours, and others are forbidden to keep poultry under the terms of a tenancy. In such cases the crowing of the cock

and the cackling of the hens are the chief causes of protest or prohibition, and it is, therefore, necessary to emphasise the fact that where eggs are wanted for eating the introduction of a male bird is a disadvantage. The cock has no appreciable influence on the number of eggs laid, and, for domestic purposes, sterile eggs are to be preferred to fertile eggs.

Objections to keeping poultry in the backyard or suburban garden would seldom be raised if the birds were kept in small numbers, as far removed as possible from adjacent dwelling houses, if the house and run were kept clean and if no cock was present.

In fairness to the interests of others, those who contemplate keeping poultry in urban districts should observe these conditions; if they do so neighbours should suffer little or no inconvenience, and, in the common interest, should raise no objection.

If six or eight healthy pullets of a good laying strain are purchased, they can be fed at very little cost by the judicious use of garden refuse, house-scraps, bran or pollard and grain.

In rural districts the number of birds which a cottager can keep is generally limited by the size of his garden. He might rear more chickens and increase his flock if he could obtain permission to run his poultry over adjoining land. With a better range the birds could be kept more economically and they would also tend to improve grass land over which they foraged.

Where suitable land adjoins his holding, the cottage poultry-keeper should endeavour to obtain permission to use it, and, if necessary, he might pay a small fee for doing so. A definite and business-like proposal should be made, as, for example, that so many adult fowls or so many chickens and no more shall be run over the land; that the means of approach specified by the owner shall be used; that fences shall not be broken; that the field shall be entered only when it is necessary to attend to the poultry, and that the house or houses shall be moved periodically to fresh ground. If permission is granted the conditions laid down should be strictly observed, and then there can be no objection to poultry ranging over suitable land adjoining the cottage. Land owners and farmers will give valuable aid to the industry by meeting such requests in a friendly spirit.

THE following Circular Letter, dated June, 1916, has been addressed by the Board to Secretaries of War Agricultural Committees:—

Irish Migratory Labourers. Insurance of Women Workers on the Land.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's Circular Letter of the 8th April last, A. 265/C,* dealing with the question of the liability of Irish Migratory Labourers in Great Britain to military service under the provisions of the Military Service Acts, 1916, and I am to enclose a copy of a Leaflet† which has been drawn up by the Employment Department of the Board of Trade on the subject. Lord Selborne understands that the Board of Trade have distributed copies of this Leaflet as freely as possible in the areas of Ireland from which the migratory labourers come, and it is hoped that this action may result in removing any misconceptions that may prevail on the subject. A copy of the Leaflet

* This *Journal* April, 1916, p. 91.
† Printed below—"Irish Migratory Labourers," p. 391.

might be sent by farmers to any individual Irish labourers with whom they are in touch.

I am also to refer to the subject of the Insurance of Women who undertake work on the land, which was dealt with in the Circular Letter quoted above, and to say that Lord Selborne has been in further communication on the matter with the National Health Insurance Commission (England). I am to enclose a copy of a revised Leaflet* issued by the Commission with a view to correcting a widely spread, but erroneous impression that women undertaking temporary work in agricultural employments cannot obtain any benefits under the National Insurance Acts. Further copies of this Leaflet may be obtained on application to the National Health Insurance Commission, Buckingham Gate, London, S.W. I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Irish Migratory Labourers.

THE President of the Local Government Board, speaking in the House of Commons on the 22nd March, 1916, said :—

"Any Irish labourers coming over (*i.e.*, to Great Britain) for employment, either on farms or in any other capacity, will not come under the Military Service Act, and will not be liable to be called upon for service."

The Military Service Act only applies to persons who were ordinarily resident in Great Britain on the 15th August, 1915, or who become ordinarily resident in Great Britain subsequently to that date.

The Act does not apply to persons not ordinarily resident in Great Britain.

It does not apply to persons residing in Great Britain temporarily or for some special purpose.

Employment of Women on the Land.

THE following Notice was published on 1st July :—The Board of Agriculture and Fisheries understand that fees are being asked for by certain agencies as a condition of offering to find employment for women on the land.

The Board wish it to be clearly understood that such payments are unnecessary in view of the arrangements made under their authority for this purpose, particulars of which can be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

Insurance of Women Workers on the Land.

The following Leaflet has been issued by the National Health Insurance Commission (England) :—

1. It appears from enquiries received by the Insurance Commissioners that there is a widespread idea that women undertaking temporary war work in agricultural or industrial employments cannot obtain any benefits under the National Insurance Acts. This impression is incorrect, and the following paragraphs set out the benefits which women war workers will receive in return for the contributions paid in respect of them.

Exempt Persons.—2. Women who undertake work for the period of the war only will ordinarily be entitled to a certificate of exemption, as

* Printed below.

explained in Memorandum 221/X., Part 1,* copies of which can be obtained on application either to the Women's County Committee or to the Insurance Commissioners. A certificate of exemption relieves the employed person of liability for her share of the contribution. The employer, however, is still required to pay his share of the contribution (which will usually be 3*d.* a week). An exempt person can apply for Medical and Sanatorium Benefits as soon as 20 contributions at the exempt rate have been paid, and she will then become entitled to the benefits six weeks after application is made. Medical Benefit means free attendance by a panel doctor and free medicine. Sanatorium Benefit means free treatment (if recommended by an Insurance Committee) either in a sanatorium, or at a dispensary, or at home in the case of persons suffering from tuberculosis. When once an exempt person has become entitled to Medical and Sanatorium Benefits she will continue in benefit as long as an average of 13 contributions are paid in respect of her for every half-year.

The exempt woman will only have to send in her contribution card at the end of each half-year to the Insurance Commissioners, and she will not be required to keep any account herself of the number of contributions on the card. Once she has received her medical card she will continue to be entitled to Medical and Sanatorium Benefits, unless she receives notice that she has been suspended from benefit because her contributions have fallen below the required number.

Insured Persons.—3. It is open to a woman war worker who is not entitled, or does not wish, to become an exempt person to apply for admission to membership of an Approved Society. Most of the large Approved Societies have local representatives in all parts of the country, and a woman desiring to join one of these societies should consult the local representative. In many rural areas there are also local societies which some women workers may prefer to join. A woman who joins an Approved Society will be entitled, as soon as the first contribution has been paid in respect of her, to Medical and Sanatorium Benefits. Sickness Benefit (*i.e.*, weekly payments during incapacity for work) and Maternity Benefit (*i.e.*, payment of 30*s.* on confinement) are not payable until the woman has been insured for 26 weeks and 26 contributions have been paid in respect of her.

An insured woman who does not join an Approved Society will become a deposit contributor and will be entitled to benefits depending upon the amount to her credit from time to time in the Deposit Contributors' Fund.

4. It will thus be seen that women war workers can secure substantial benefits in return for the contributions paid in respect of them, and it is not the case that their contributions will be wasted unless they remain permanently in employment.

The following Notice was issued by the Board on 23rd June, 1916:—

Women Farm Workers.

In many parts of the country there appears to exist a suspicion that, if women register their names for farm work, they may be subjected to some form of compulsory service.

The War Office and the Board of Agriculture and Fisheries desire to assure all women who are engaged in work on the land, or who may be willing to undertake such work, that

the registration of their names for that purpose will in no way be used to compel them to undertake either agricultural or any other form of work. *Such work is entirely voluntary.* In no case will they be asked or expected to work on farms outside their own neighbourhood unless they are willing to do so. But it is necessary, in order that the most efficient use may be made of their services, to have a list of the names and addresses of women who are prepared in the national emergency to undertake work in the place of the men who are fighting in the trenches. As there is a great need for the services of patriotic women who are willing to assist in the home production of food, it is hoped that all women who can see their way to offer their services, either whole or part time, will at once have their names registered at the local Labour Exchange or by the village Registrar.

Parliamentary Questions and Replies on Agricultural Matters.

THE following questions relating to matters of importance to agriculturists have recently been asked in the House of Commons, and as the replies given to them may be of interest to the members of War Agricultural Committees, they are circulated for their information :—

1. *Fruit Traffic.*—Major Wheler (31st May) asked the Parliamentary Secretary to the Board of Agriculture whether it will be possible to make known to fruit growers at an early date during the summer any special arrangements that may be arranged by the railway companies for the conveyance of fruit ?

Mr. Acland : I have no doubt that fruit growers will, as usual, be able to learn the arrangements which will be made by the railway companies for fruit traffic by application at their local stations. If there is any suggestion that in any particular case these arrangements are not being made, or are not being made available to growers in good time, I shall be glad to approach the company concerned.

2. *Hay and Corn Harvest.*—Major Hunt (31st May) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the difficulties of obtaining sufficient labour for the hay and corn harvest, he could see his way, by legislation or otherwise, to compelling employers of men servants engaged in unproductive work to release them for a fortnight during the hay harvest and a month during the corn harvest for the purpose of assisting the farmers to harvest their crops ?

Mr. Acland : I think that the best way of securing the object which the hon. and gallant Member has in view will be by the action of War Agricultural Committees, whose members have great influence among their friends and neighbours. I am sure that they will do their utmost to secure the temporary release of all available men, women, and children for the ingathering of the harvest.

3. *Vacant Land Cultivation.*—Sir Stuart Coats (31st May) asked the Parliamentary Secretary to the Board of Agriculture whether the Board, in the interest of our national food supplies, will consider the advisability as a matter of national importance, of taking steps, by legislation or otherwise, to ensure that the owners of pieces of waste or vacant land should give every possible facility to local authorities or societies which are willing to arrange for their cultivation for the period of the War ?

Mr. Acland : The Board agree that every facility possible ought to be given by owners of waste or vacant lands to local authorities or societies who can arrange to cultivate them during the War, and they are glad of this opportunity of emphasising the fact. They considered the advisability of bringing in legislation, but, as at present advised, have decided against it, because they felt that they could confidently rely on the patriotism of owners of vacant lands to lend or let them for the purpose referred to.

4. *Agriculture and Horticulture.*—Colonel Griffiths (1st June) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the shortage of labour for work on the land, he proposes to take any steps to divert the immense amount of labour used in horticulture for work on the land, with a view to compelling owners of glasshouses, nursery gardeners, etc., to produce vegetables and other necessities of life in place of flowers ?

Mr. Acland : The question to which the hon. and gallant Member calls attention is of great importance, but I believe that, on the whole, owners of gardens are using the staffs which remain to them—which in general have already been very heavily depleted—so as to keep up the production of vegetables to the highest point. The County War Agricultural Committees are, I think, always glad if particular cases are brought to their notice to use their influence to secure this result.

5. *Milk Prices.*—Mr. Nield (31st May) asked the Parliamentary Secretary to the Board of Agriculture whether he has received any information with reference to the enhanced price for milk and the threat of farmers to milk dealers that, unless increased prices for milk are paid, farmers will fatten and sell to the butchers many cows now in milk ; and whether he will publish a warning that proceedings will be taken by the Board against any farmer so acting ?

Mr. Acland : I am aware both of the increased price of milk and of the increased cost of milk production. I am not aware of the threat alluded to, and I fancy that the point which the farmer desires to make is only that if milk production does not pay he will give up producing it. As to taking proceedings, it is not at all an easy matter to compel men to carry on businesses which do not bring in a reasonable profit, and I believe that in the long run the best way of keeping up our milk supply is to pay a price which will yield to the producer a fair return for the increased cost of labour, feeding-stuffs and cows, and not less remunerative conditions than other branches of agriculture.

THE following Circular Letter on the subject of Cleanliness in the Dairy was addressed by the Board to the Secretaries of Women's Farm Labour Committees on the 17th June, 1916 :—

Cleanliness in the Dairy.

MADAM (or SIR),—Now that so many women are coming into contact with agricultural industries and, at the same time, such great interest is being taken throughout the country with regard to the safeguarding of infant health, it has occurred to Lord Selborne that some contribution may be made towards guaranteeing the cleanliness of the milk supply by circulating to women working on farms, and especially to those who are likely to get employed in dairies the Leaflet*

* See Leaflet No. 151, to be obtained free of charge on application to the Board.

issued by the Board, of which a copy is enclosed, dealing with "Cleanliness in the Dairy."

The Board will be glad to supply on application as many copies of this Leaflet as your Committee may see its way to make use of in the manner suggested.

I am, etc.,
SYDNEY OLIVIER, *Secretary*.

Display of Board's Notices at Markets.

THE President of the Board of Agriculture and Fisheries has had his attention drawn to an arrangement made between the War Agricultural Committee and the Market Authorities of one of the Eastern Counties for the erection in the various markets of Notice Boards to be used for the display of all Notices sent out by the Board of Agriculture and Fisheries in connection with the work of the County Committee.

Lord Selborne considers that this arrangement is likely to serve a very useful purpose in bringing to the notice of farmers attending the markets information relating to the conditions affecting their interests arising out of the War, and he suggests that County Committees generally should take steps to arrange with Market Authorities for the display of the Board's Circulars and Notices in the County Markets.

Recruiting and the Growing of Fruit Trees.

THE following Circular Letter, dated 15th June, 1916, has been addressed by the Board to their representatives before the Local and Appeal Tribunals :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that he has had under consideration the question of the recruiting of men who are concerned in the production of fruit trees.

In view of the fact that the maintenance of a sufficient supply of fruit trees is of the greatest importance, Lord Selborne would be glad if you will take all possible steps to support any application or appeal which may come before your Tribunal for exemption from military service of any foreman employed by nurserymen who deal in such trees.

I am, etc.,
SYDNEY OLIVIER, *Secretary*.

Appeals regarding Certificates of Exemption from Military Service.

THE following Circular Letter, dated 17th June, 1916, has been addressed by the Board to their representatives before the Local Tribunals :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to advert to the Memorandum A.198/L with regard to military service, a copy of which has already been sent to you, and I am to call your particular attention to an important change of procedure with regard to the powers of Local Tribunals in regard to the granting of Certificates of Exemption.

Under the Regulations and Instructions recently issued, a Certificate of Exemption, which may be absolute, conditional or temporary, as the Local Tribunal may think best suited to the case, may be granted by a

Local Tribunal *subject to the condition that it shall not be renewable or open to variation, except on an application made with the leave of the Tribunal. The decision of the Tribunal granting or refusing leave under this provision is final.*

Any person aggrieved by a decision of the Local Tribunal can appeal to the Appeal Tribunal not later than three clear days after the date of the written decision of the Local Tribunal, but it is not open to him to appeal when he applies for a renewal of a certificate which has been granted on the condition that it shall not be renewable or open to variation except on an application made with the leave of the Tribunal.

If, therefore, an applicant to your Local Tribunal is granted a Certificate of Exemption for, say one month, subject to the condition above referred to, he must at once decide whether the period of one month is sufficient, and if it is not, he must appeal within three days of the decision of the Local Tribunal to the Appeal Tribunal as he will have no right of appeal subsequently except by leave of the Local Tribunal.

Lord Selborne would be obliged if you would take steps to ensure that applicants to your Local Tribunal are aware of the position as indicated above.

I am, etc.,
SYDNEY OLIVIER, *Secretary.*

THE following Memorandum was issued to the Board's representatives before the Local and Appeal Tribunals in England and Wales on 21st June, 1916 :—

Conditions for Granting a Certificate of Exemption from Military Service.

The Regulations and Instructions to Tribunals provide that no Certificate of Exemption can be conditional upon a person to whom it is granted continuing in, or entering into employment under any specified employer, or in any specified place or establishment.

This does not, however, prevent the Board's representative from suggesting to the Tribunal that a skilled agricultural worker, not absolutely indispensable on the farm on which he is employed at the time of application, should be granted a Certificate of Exemption on condition that he obtains similar employment within a short period under some other employer.

It may happen that a parish is short of agricultural labour generally, and although the Tribunal may be of opinion that the man is not indispensable on the farm on which he is employed, yet he might be urgently required on an adjoining farm, and the Board's representative should not fail to put this aspect of the case clearly before the Tribunal.

THE following Circular Letter, dated 12th June, 1916, has been issued by the Board to their representatives before the Local and Appeal Tribunals in England and Wales :—

Military Service: Exemption of Veterinary Surgeons.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that he had has under consideration the effect upon the agricultural interest, both at the present time and in the future, arising from the call made

upon the Veterinary Profession for service with the Forces, either in a professional capacity or otherwise.

Lord Selborne understands that a very substantial proportion—probably about one-half—of the qualified veterinary surgeons engaged in private practice in Great Britain have joined the Army Veterinary Corps or have undertaken professional work on behalf of the Military Authorities. A dearth of veterinary surgeons in country districts has accordingly arisen, the ill effects of which are already apparent.

If practising veterinary surgeons were now to be taken in any considerable number for the performance of ordinary military duties the result would be very prejudicial to agricultural interests, and Lord Selborne considers that it is of importance that Tribunals should have this in mind in considering applications for exemptions from military service put forward by practising members of the veterinary profession.

I am accordingly to ask you to take such action as may be necessary to secure that the attention of the Tribunal shall be drawn specially to this aspect of the matter when considering such application. The following points could be usefully brought out by questions to the applicant, viz., the approximate area covered by the applicant's practice; the number of qualified veterinary surgeons available in normal times in or in the immediate neighbourhood of such area, say, within 15 miles of the applicant's residence; the number now available; the character of the practice, with special reference to the number of farmers amongst his regular clients, and how their requirements could be supplied in his absence.

If the applicant is acting for a fellow practitioner who is absent on military duty that fact should be brought to the notice of the Tribunal.

It is also to be noted that a number of such veterinary surgeons are employed by the Board and by the Local Authorities in connection with the control of contagious diseases amongst animals. This business must be regarded as work of national importance, and the fact that an applicant is so employed should, in Lord Selborne's opinion, greatly strengthen his claim for exemption.

As regards the future, it is apparent that unless the supply of students at veterinary colleges can be maintained during the War, qualified veterinary surgeons will not be available in sufficient numbers to replace the wastage of the profession, and the ill-effects arising will be felt not only by agriculturists but also in connection with the filling of public appointments and the carrying on of veterinary research work. Already nearly the whole of the veterinary students who were of military age and physically fit have, Lord Selborne understands, abandoned their studies in order to join the Army, and the lowering of the minimum age for military service from 19 to 18 years will, it is anticipated, have the effect of taking away from the colleges nearly the whole of the remaining students, except a small number who are left in their third and fourth years of study. Moreover, it appears certain that no more than a negligible number of students can now be expected to enter the colleges in view of the liability to military service on reaching the age of eighteen.

It appears to Lord Selborne that it would be contrary to the national interests, and more particularly to those of agriculture, that the education of veterinary students should be entirely suspended during the continuance of the War. If, therefore, the Tribunal should have before them an application for exemption on the part of a *bona fide* veterinary

student Lord Selborne would be obliged if you will bring the above-mentioned considerations to the notice of the Tribunal and urge that an exemption should be granted for such period as the professional education of the applicant continues.

In the event of the decision of a Local Tribunal not being in harmony with the views put forward in this letter, representatives before such Tribunals should be careful to see that the applicant is aware of his right to appeal to the Appeal Tribunal within three days of the decision of the Local Tribunal.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

Employment of Civilian Prisoners of War in Agriculture.

In reference to their Letter of the 14th February last (A. 258/C), relative to the Employment of Prisoners of War upon Farms, the Board have directed a further Circular Letter, dated 26th June, 1916, to Secretaries of the War Agricultural Committees in England and Wales. It is pointed out that, with a view to assist farmers in meeting the shortage of labour, Lord Selborne has been in communication with the Home Office on the subject of the employment in agriculture of certain selected Austro-Hungarian and Turkish civilian prisoners of war. The Secretary of State for the Home Department is of opinion that, in districts which are not "prohibited areas," such prisoners might be usefully employed by farmers who apply for the services of this class of labour.

For the information of the Committees the Board enclosed (1) a copy of a Memorandum* prepared by the Home Office explaining the scheme which has been prepared for the employment of these prisoners in such districts, and (2) a form of application† to be used by farmers who desire to avail themselves of the services of prisoners. When completed, the application forms should, as indicated thereon, be sent to the Secretary, Prisoners of War Branch, Home Office, Whitehall, London, S.W., and the postage need not be prepaid.

Memorandum: Employment of Civilian Prisoners of War in Agriculture.

The following Memorandum on the proposed employment of certain selected civilian prisoners of war in agriculture has been prepared by the Home Office:—

To assist in meeting the serious shortage of farm labour it is proposed to choose certain civilian prisoners of war from the internment camps, who have good records, and are trustworthy men so far as is known, and to release them, on parole and on suitable conditions, to such employers of agricultural labour in non-prohibited areas as may apply for them. The men chosen will not be Germans. They will be subjects of Austria-Hungary, and perhaps of Turkey. They will, so far as practicable, belong to the races which are, generally speaking, friendly to the Allies, such as Czechs, Poles, or Southern Slavs. They will be able to speak at any rate a little English, or if there are men otherwise suitable who cannot speak English, it may be possible to arrange to send a small group of three or four with an interpreter. It will be possible in many, if not most, cases to send men already accustomed to farm work. Where they are not accustomed to farm work the men will at any rate be able-bodied and used to labouring work.

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* Printed below. † Not here printed.

The conditions on which such a man can be employed are stated on the attached form,* which has to be filled up by anyone wishing to apply for such labour. They are briefly as follows :—

The employer undertakes, in the case of each man, to—

(*a*) Tell the police when he arrives.

(*b*) Lodge him on his premises : and remember that he may not change his address, nor travel more than five miles from his (the employer's) house, without getting special permission from the police.

(*c*) Feed him.

(*d*) Pay him at the district rate paid to English labourers for the work, on the understanding that he is entitled to deduct the cost of the man's board and lodging at the rate of 10s. a week.

(*e*) Tell the police *at once* if he should misconduct himself in any way, or should abscond ; or if he should want to dismiss him.

(*f*) Discontinue his employment at the end of the War, or as soon thereafter as British labourers are available.

The man on his side will undertake, as a condition of his release—

(*a*) To do nothing that could harm the British Empire or its Allies in any way (this is the ordinary parole which has to be signed by any civilian released from a camp before he is allowed to leave).

(*b*) To conduct himself properly in every way.

(*c*) To take the employment given him and remain in it as long as he is wanted.

On receipt of an application a selected man will be despatched as quickly as possible to the applicant's address, free of cost to the applicant. Should he in any way misconduct himself, or should the employer have other reasonable ground for wishing to terminate the employment, he has only to tell the police and they will take the man back to the camp, also free of cost to the employer.

An interned man cannot be released to a prohibited area.

THE following Notice was issued by the Board on 28th June, 1916 :—

Transit of Fruit and Empties.

The President of the Board of Agriculture and Fisheries, in view of the strain now falling on the railway systems of the country, desires to urge fruit and vegetable growers and salesmen to do all they can during the continuance of the war to assist the railway companies in the handling of produce and empties.

Fruit should be sent to the most accessible markets in approximately regular daily quantities. Whenever possible fruit should be disposed of locally.

Growers should put together their consignments to salesmen in lots of two or four tons, and advise their station overnight of the quantities they wish to forward the following day.

All salesmen should open their stands by the time the first deliveries of fruit are made by the railway companies and discharge the vans immediately.

In returning empties salesmen should put together the lots for each grower so that they can be transferred direct from van to truck without further sorting at the station, and make up full truck-loads.

Growers should clear empties from the country stations promptly.

Sellers should not send empties to country stations on the chance of finding a grower who will make use of them.

Utilisation of Common Land.

THE following Notice was issued to the Press on 3rd July: In view of the importance of increased food production, it may be useful to call attention to the existing statutory powers for the temporary use of land subject to rights of common. Under section 15 of the Inclosure Act, 1773 (13 George III., chapter 81) it is competent for the lord of a manor, with the consent of three-fourths of the commoners in meeting assembled, to lease by auction a part not exceeding one twelfth of the common for not more than four years; and the net rent is to be applied by the lord and the major part of his tenants in draining, fencing or otherwise improving the residue of the common.

In the case of common land which is not at present frequented by the public, it may be possible to take advantage of this power of temporary use, while at the same time providing for the eventual improvement of the common.

Auxiliary and Holiday Labour for the Harvest.

THE following Circular Letter, dated 28th June, 1916, has been addressed by the Board to the Secretaries of the County War Agricultural Committees:—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's Circular Letter of the 23rd April last (A.266/C)* calling attention to the desirability of making use of all available sources of auxiliary and holiday labour for the harvest, and I am to draw your Committee's attention to the possibility of obtaining the services of men of the National Volunteer Training Corps for harvest work.

I am to suggest that the Representative of the War Agricultural Committee, appointed in accordance with paragraph 2 of the Board's Circular Letter of the 5th June (A. 270/C)† to negotiate with the Military Authorities for the supply of soldier labour, might enquire of the Commandant of the local Volunteer Corps whether he can provide any assistance in harvest.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Loan of Horses to Farmers for Harvesting.

In view of the shortage of agricultural labour and of the special importance of satisfactorily gathering this year's hay and corn harvest, the Army Council have issued Instructions, dated 25th June, 1916, that commanders of units in possession of draught horses or mules shall arrange, as far as is compatible with military requirements, for the temporary loan for harvesting of horses and drivers to farmers in the vicinity of their stations who may require such help.

Payment must be paid by farmers at the rate of 4*s*. per diem for each horse for a working day of eight hours, farmers supplying, without charge, forage, and, where necessary, stabling. Drivers must be paid by the farmer at the rates indicated in a previous Memorandum. Horses will only be sent out with their own drivers, and, where possible should return to quarters each night.

Payment for the horses must be made at the end of each week.

Applications for horses and drivers should be made direct by the farmer to the nearest commander of a unit that is in possession of draught horses or mules.

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* This *Journal*, May, 1916, p. 192. † This *Journal*, June, 1916, p. 289.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

War Gardening in France.—A Circular of the French Ministry of Agriculture of 11th May, 1916, calls upon the directors of agricultural services in France to co-operate with the committees of agricultural action, agricultural societies and syndicates, in the investigation of practical measures for increasing the amount of gardening carried on, and for putting the opportunity of cultivating gardens within reach of even the humblest. It is stated that gardening, with the natural accompaniment of pigeons, rabbits, pigs, and goats, appears to be one of the most practical means of increasing the amount of food available for French families and soldiers.

No difficulty from the labour point of view is anticipated, this being abundantly supplied by the members of the family; aid is further hoped for from refugees who can thus partly alleviate their unfortunate lot. Efforts will be made to get schoolmasters to instruct their scholars in gardening, or, where this is already done, to create model gardens.

Further, the directors of agricultural services are to get into touch with municipalities with a view to obtaining the use of vacant land.

The difficulty of obtaining seeds and implements will be surmounted by the aid of the communal committees of agricultural action and by recourse to the agricultural credit banks; voluntary aid is also hoped for.

Much gardening has been done by soldiers behind and around cantonments, some of these gardens being "the admiration of professional gardeners." The Ministry of War has instructed the military authorities that kitchen gardens, and even small fields, shall be brought under cultivation wherever possible by soldiers round cantonments.

The principal organiser of workmens' gardens in the north of France has been given the duty of collaborating with the directors of agricultural services in the development of civil and military gardens.

War Vegetables in Germany.—The need for the greatest possible production of food in Germany during the war has been thoroughly impressed on the German people, and much seems to have been done in the direction of increasing the number of small gardens. The German Government has published an appeal in the *Deutscher Reichsanzeiger* asking that every cultivable piece of German land shall be devoted to food production, not only on agricultural holdings, but also in towns. Attention is drawn to vegetables and potatoes as suitable crops, and it is urged that societies founded specially for the purpose, or the communal authorities, should take the work in hand. Helpful experience has been gained from similar work in 1915. The principal method to be adhered to is the leasing out in small lots of any land taken; the extent to which cultivation and seeding can be left to the individual holders will depend upon whether these belong to the agricultural and gardening classes or not. The communes or societies can, however, themselves carry out the work, the crops being sold at moderate prices, and especially to needy families, or else sent direct to the "people's kitchens" or to the "war restaurants." Great insistence is laid on the need for careful preparation of the ground, proper manuring, best seeds, and clean cultivation in order to obtain the maximum output.

From a report on the work accomplished in Saxony in 1915 it appears that the first course tried, viz., public appeals by the communes

urging the cultivation of unused land, failed completely; satisfactory results were, however, obtained when the communes, induced by an emphatically worded order of the Ministry of the Interior, together with the promise of loans at low rates or free of interest, created special committees for the purpose. A total of about 1,360 acres of gardens was thus added in Saxony; 65 per cent. was unoccupied or building land, and 35 per cent. was grass or bare forest; most of the land so brought under cultivation was communal property, but the Saxon State railways also lent about 137 acres; four-fifths of the land was planted with potatoes, and the remaining one-fifth with vegetables. The crops were generally satisfactory, and often very good, failures being ascribed to weather, poor soil, and only exceptionally to inefficient cultivation. With regard to organisation, the two extreme forms were communal cultivation, and the lease of the bare plot; intermediary forms were: Leasing of ploughed and manured land (seeding and harvest left to holder), and leasing after putting in the seed potatoes (when only the harvest was left to the holder); in some cases the bare land was let to gardeners' societies who prepared the land for seeding, or even did all the work previous to harvest before handing the land over to other holders.

Besides the above measures for the extension of gardening, efforts have been made for the increase of vegetable growing on moorland. At a meeting of 20th February last the German Moor Culture Union decided on a policy of model vegetable gardens on moors. Manures, seeds, plants, plan of cultivation, and advice are to be supplied free to demonstrators, and grants are to be given in aid of the cost of enclosing and pumping; the demonstrators are further to receive from 3*s.* to 5*s.* per 120 sq. yd. remuneration, and the crops will remain their property. They must follow instructions as to cultivation, manuring, seeding, planting, weeding, spraying, and harvesting.

According to a notice in the *Deutscher Reichsanzeiger* of 18th May the Moor Culture Union has decided to grant allowances to wounded agriculturists, etc., who wish to take up moor culture, for the purposes of obtaining training.

Towards the end of May the German Government gave notice of the foundation of an Imperial Office for Vegetables and Fruit, with two divisions, viz., an Administrative Division, the members of which are appointed by the Imperial Chancellor, and which has an advisory council, and a Business Division, constituted as a limited liability company. The aim of the Office is to further the production, sale and preservation of fruit and vegetables. The Business Division is to announce which kinds of vegetables and fruit it wishes to obtain, under which conditions, and at which receiving offices (these last are to be established); those who *wish* to dispose of their vegetables and fruit under the conditions specified are to inform the Office of the fact, and the Business Division will then buy through its receiving office.

Farmers and others who carry on vegetable and fruit-preserving *must* undertake such work in this connection as is allotted to them by the Business Division, and must carry it out carefully, the remuneration being fixed by the Business Division; in the event of refusal a third party can be authorised to carry out the work with the farmer's apparatus and at his expense.

The Sugar Position in Germany.—Since the outbreak of war a notable change has come about in the position of Germany with regard to the sugar supply. At first a flooding of the market with

consequent very low prices was feared, but the sugar law of 31st October 1914, and the use of sugar as a stock food seem to have prevented this. In 1915 the area under sugar beet was reduced by 31·6 per cent., the yield per hectare fell from 34 metric tons to about 26 or 28 tons, and the sugar consumption, both by the human and animal population, increased. These factors led to the surplus being replaced by a scarcity of sugar. To avoid scarcity it was necessary to secure an increase in the area under sugar beet. In view of the facts that cereals competed strongly with sugar beet, that the scarcity of feeding stuffs led to the cultivation of fodder roots in place of sugar beets, and that both labour and capital had become dearer, the only possible method (apart from compulsory sugar beet cultivation) was to offer farmers higher prices for their sugar beets. This was done by the Bundesrat Order of 4th February, 1916. This Order related to the prices of raw sugar and sugar beets from 1st October, 1916, onwards, and increased the price of raw sugar by 3 mark per 100 kilogs. (*i.e.*, by about ·45 mark per 100 kilogs. for sugar beet.).—(*Deutscher Reichsanzeiger.*)

The Rise in Agricultural Wages in Russia.—The Russian volume of agricultural statistics for 1916 (*Sbornik Statistiko-Ekonomitscheskich Svjedjenii po Selskomu Chozjaist u*), issued recently by the Russian Ministry of Agriculture, gives figure of the average earnings of agricultural day labourers at different seasons over a number of years. The figures show a steady increase since 1901-5, the level in 1914 being about 50 per cent. higher than in 1901-5. The following figures are extracted from those given, and relate to the mean of the average day's wages in the fifty governments of European Russia (*i.e.*, excluding Poland and Caucasus):—

SEEDING.

	Men.		*Women.*	
	Without Food.	*With Food.*	*Without Food.*	*With Food.*
	d.	*d.*	*d.*	*d.*
1901–5	13¾	10½	8½	6¼
1906–10	15¾	12	10	7¼
1910	16¾	12¾	10¾	7¾
1911	17	12½	10½	7¾
1912	18	13½	11½	8½
1913	19¼	15	12¼	9
1914	21¾	16¾	13¼	10

HAY HARVEST.

	Men.		*Women.*	
	Without Food.	*With Food.*	*Without Food.*	*With Food.*
	d.	*d.*	*d.*	*d.*
1901–5	17½	14¼	10¾	8½
1906–10	20¼	16	12½	9¼
1910	21¼	16½	12½	10
1911	21	16¾	12¾	9¾
1912	23½	18¾	14¼	10¾
1913	25¾	20½	15	11½
1914	28¼	22½	16¾	12¼

CORN HARVEST.

	Men.		*Women.*	
	Without Food.	*With Food.*	*Without Food.*	*With Food.*
	d.	*d.*	*d.*	*d.*
1901–5	17½	14¼	12¾	9¼
1906–10	20	16¼	13¼	10¾
1910	21¾	17¼	14¾	11¾
1911	21	16¾	14¼	11¼
1912	24¼	19¼	16¼	13
1913	27	21¾	18¼	14½
1914	26½	21	17½	13¾

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for June, 1916, issued by the International Institute of Agriculture, contains information regarding the sowing of cereals in the Northern Hemisphere. The areas estimated to have been sown with *wheat* in 1915–16, compared with the areas sown during the corresponding period in 1914–15, expressed as percentages, are as follows: Denmark 100, Spain 102, France 91, England and Wales 94, Italy 94, Norway 110, Rumania 103, Switzerland 107, Canada 88, United States, winter 79, spring 92, British India 93, Japan 102; with *rye*—Denmark 100, Spain 117, France 89, Italy 101, Norway 130, Rumania 105, Switzerland 105, Canada 96, United States 87; with *barley*—Denmark 100, Spain 92, France 87, Italy 100, Norway 110, Rumania 92, Switzerland 109, Canada 91, United States 105, Japan 96; with *oats*—Denmark 100, Spain 95, France 90, Italy 102, Norway 110, Switzerland 110, Canada 92, United States 100, Japan 96. The crop conditions are generally satisfactory in France, Great Britain, Italy, Luxemburg, Sweden, and Egypt, but less so in Hungary and Switzerland, while the season is very late in Ireland, the Netherlands, and Canada.

Forecasts are also given of the production of cereal crops this year, the following being the most important: *Wheat*—United States, winter 58,595,000 qr. in 1915–16, against 81,859,000 qr. in 1914–15, a decrease of 28·4 per cent.; spring 30,785,000 qr. against 44,546,000 qr., a decrease of 30·9 per cent.; British India 39,739,000 qr., against 47,908,000 qr., a decrease of 17·1 per cent. *Rye*—United States 5,093,000 qr. against 5,737,000 qr., a decrease of 11·2 per cent. *Barley*—United States 22,706,000 qr. against 28,432,000 qr., a decrease of 20·1 per cent.; Japan 11,975,000 qr. against 12,100,000 qr., a decrease of 1 per cent. *Oats*—United States 128,632,000 qr. against 157,942,000 qr., a decrease of 18·6 per cent.

Russia.—The Official Report published on 14th June states that up to 23rd May the condition of winter cereals in nearly the whole of European Russia was highly satisfactory. Only a little re-ploughing was done in the south and south-eastern parts of the black soil regions. With very few exceptions, the shortage of labour has not caused any sensible decrease in the acreage seeded. (*Broomhall's Corn Trade News*, 28th June.)

Italy.—The Official Report for the period 1st to 10th June states that wheat is generally promising, though in some parts of Northern Italy it has been laid by bad weather, and in many others maturation has been too precocious owing to unfavourable weather. Maize and herbaceous plants are generally favoured by the damp weather. The frequent rains hindered the seasoning of the abundant hay crop of the meadows. (*Broomhall's Corn Trade News*, 26th June.)

United States.—The Crop Reporting Board of the Department of Agriculture, in reporting on crop conditions on 1st July, states that the total production of winter wheat is estimated at 489,000,000 bush., as compared with a yield of 655,045,000 bush. last season; spring wheat at 27,000,000 bush. against 356,460,000 bush.; maize at 2,866,000,000 bush. against 3,054,000,000 bush.; oats at 1,317,000,000 bush. against 1,540,362,000 bush.; barley at 205,000,000 bush. against 237,009,000 bush. The condition of rye was 87·0 as compared with 92·0 last year. The amount of last years' wheat still remaining in farmers' hands is estimated at 73,760,000 bush. (*Broomhall's Corn Trade News*, 8th July.)

Canada.—The High Commissioner for Canada, in a report dated 30th June, states that weather conditions in Manitoba were favourable for the growing crops. Wheat was from five to seven inches high, oats and barley covered the ground well, and pastures and hay were doing exceptionally well. In Saskatchewan and Alberta all crops were in excellent condition.

India.—According to the Final Government Estimate the total area under wheat is 30,143,000 acres, as compared with 32,475,000 acres, the revised final area last year. The total production is estimated at 8,518,000 tons, against 10,091,000 tons last year. (*Broomhall's Corn Trade News*, 5th July.)

Fruit and Potato Crops in Holland.—His Majesty's Consul-General at Rotterdam reported that, on the 1st June, prospects for the fruit crop in Holland were far below those of last year A much smaller yield than the abundant crops of apples and pears last year was to be expected. In general, prospects are better for apples than for pears, although some complaints were heard about diseases. The condition of cherries was not so favourable as the first blossoming promised. "English" plums were a failure, but the other plums were more promising. Garden produce was very satisfactory. The condition of early potatoes was very good in Groningen, West Friesland and Hillegom; good to very good in the other parts of Friesland and Gelderland, south of the Rhine; fairly good to good in Limburg, Overyssel, North Gelderland and North Brabant; and moderate in South Holland, where they suffered from water.

Agricultural Conditions in England and Wales on 1st July.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st July, state that the weather during June was cold, especially during the first fortnight, but the rainfall was moderate. Crops accordingly made comparatively little growth during the month, and all are backward, while in some districts prospects have somewhat deteriorated. Warmer weather would effect a very general improvement. Wheat looks fairly well generally, but is not expected to be up to the average, while barley and oats are also below the mean. Straw will probably be rather short. On the whole, the corn crops appear to be best in the north. Beans are promising, and should yield a full average; but peas are not quite so satisfactory.

Potatoes, backward like the other crops, are strong and vigorous generally, and may yield an average crop. Some frosts occurred in the north, but the crop does not seem to have taken much harm from them.

Turnips and swedes, where showing above ground, are coming away nicely throughout the country, but a considerable breadth remains to be sown. Mangolds are hardly satisfactory; the weather has allowed them to make very little growth, and in some districts they are rather a thin plant. The area under roots is probably smaller than last year, partly on account of the substitution of corn crops; but cabbages, mustard, etc., have in many cases been substituted, owing to scarcity of labour for hoeing, and the latter reason has also led to some fields being left fallow.

Very little hay has yet been got in, and the season must be quite a fortnight late. In the north it is only just commencing, and many

districts have not yet started. Where hay-making was begun early in June progress has been very slow, owing to the cold and sunless weather which prevailed in most parts. The crop is decidedly above average.

Pastures are rather variable; in most districts there is plenty of grass, but in many others growth has been so slow that they are beginning to look bare. Live stock have done satisfactorily considering the circumstances.

Hops are quite healthy, although backward. Very little fly is reported, and in some areas washing has been up to the present almost unnecessary. The western districts anticipate an average crop on present appearances, but prospects in Kent are not quite up to the normal.

Orchards give poor prospects, especially apples and pears, and plums seem little better, but cherries are not much below average. Small fruit is more nearly an average, strawberries being perhaps rather short, raspberries a little over average, and gooseberries generally abundant.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on the 1st July indicated probable yields per acre which may be denoted by the following percentages: Wheat, 96; barley, 95; oats, 95; beans, 101; peas, 98; potatoes, 100; mangolds, 96; seeds' hay, 107; meadow hay, 104; hops, 96.

Agricultural Labour in England and Wales during June.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st July, the supply of labour was still everywhere deficient, and, although wages tended to rise, it was difficult to get temporary help for hay-making and turnip-hoeing. In the latter operation, more especially, women were helping to some extent, and some help was being given in certain areas by the military.

The following is an account of the conditions in the various districts:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour was still very deficient, but the arrival of Irish labourers, which was reported from parts of Durham, will help farmers considerably.

Lancashire and Cheshire.—Labour was generally scarce, and farmers in some districts were having difficulty with their hay; while many women were being employed, chiefly for turnip-hoeing. Wages were considerably higher than a year ago.

Yorkshire.—Labour was very deficient; wages tended to rise, but the labour was not to be had, and women did not seem to be so much employed in this county as in some others. Horsemen were scarce in the east.

Shropshire and Stafford.—Labour generally was deficient, and there were hardly any temporary hands to be had.

Derby, Nottingham, Leicester and Rutland.—The supply of labour was still very deficient. Female labour was being utilised in some districts, and soldiers were helping with the haymaking.

Lincoln and Norfolk.—The supply of labour was very deficient; the employment of soldiers was reported in some districts.

Suffolk, Cambridge and Huntingdon.—Labour was everywhere very scarce, and it was expected that the assistance of soldiers will be wanted at harvest.

Bedford, Northampton and Warwick.—The supply of labour was very deficient, but the employment of women was reported in some districts.

Buckingham, Oxford and Berkshire.—The supply of labour continued to be deficient, but women were assisting in most districts, and soldiers were being employed in central Berkshire.

Worcester, Hereford and Gloucester.—Labour was very deficient; in some districts a certain number of women and soldiers were assisting.

Cornwall, Devon and Somerset.—The supply of labour was very deficient, especially for hoeing and hay-making.

Dorset, Wiltshire and Hampshire.—The supply of labour was generally deficient. The employment of women was reported from some districts.

Surrey, Kent and Sussex.—Labour was still very deficient throughout the division, and the employment of female labour was reported in parts of Surrey.

Essex, Hertford and Middlesex.—The shortage of labour was still keenly felt, and it was difficult to keep the land clean in consequence.

North Wales.—There was a great scarcity of labour, particularly among temporary hands for hay-making.

Mid Wales.—Labour was still very scarce throughout the district.

South Wales.—The supply was still deficient, but the employment of women was reported from some districts.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st July, 1916, certain diseases of animals existed in the countries specified:—

Austria (on the 17th May).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of April).—Anthrax, Foot-and-Mouth Disease (88 outbreaks), Foot-rot, Swine Erysipelas, Swine Fever.

France (for the period 21st May—3rd June).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies. Swine Erysipelas, Swine Fever.

Germany (for the period 15th—31st May).—Pleuro-pneumonia, Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of May).—Anthrax, Foot-rot, Glanders, Swine Erysipelas.

Hungary (on the 17th May).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 5th—11th June).—Anthrax, Foot-and-Mouth Disease, (1,034 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of May).—Anthrax, Blackleg, Swine Fever.

Rumania (for the period 1st—8th May).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of Jan.).—Anthrax, Foot-and-Mouth Disease (16,549 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of Feb.).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of May).—Anthrax, Blackleg, Foot-and-Mouth Disease (19 outbreaks), Swine Erysipelas.

Switzerland (for the period 12th—18th June).—Anthrax, Blackleg, Foot-and-Mouth Disease (5 "étables" entailing 55 animals, of which 5 "étables" were declared infected during the period), Rabies, Swine Fever.

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during June.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending June 3rd:								
England, N.E. ...	52·3	0·0	0·30	8	— 3	4	6·4	+0·1
England, E.	53·7	—0·7	0·09	2	—10	2	7·8	+0·8
Midland Counties ...	53·0	—1·2	0·15	4	— 9	2	6·5	+0·3
England, S.E. ...	53·7	—1·8	0·06	1	—11	1	8·6	+1·6
England, N.W. ...	51·6	—2·2	0·62	16	+ 3	4	7·8	+1·0
England, S.W. ...	52·5	—2·2	0·32	8	— 4	2	8·5	+1·6
English Channel ...	54·8	—0·7	0·05	1	—12	2	10·7	+2·7
Week ending June 10th:								
England, N.E. ...	49·6	—3·7	0·84	21	+10	5	4·7	—1·6
England, E.	51·0	—4·3	0·94	24	+11	6	6·4	—0·4
Midland Counties ...	49·8	—5·7	0·75	19	+ 7	5	4·5	—1·7
England, S.E. ...	50·3	—6·1	1·05	27	+14	6	6·9	0·0
England, N.W. ...	49·8	—5·0	1·06	27	+16	5	4·4	—2·5
England, S.W. ...	49·8	—5·9	0·96	24	+11	5	7·1	+0·2
English Channel ...	50·8	—4·8	0·46	12	+ 1	5	9·1	+1·2
Week ending June 17th:								
England, N.E. ...	48·0	—6·3	0·32	8	— 2	3	3·7	—2·5
England, E.	49·1	—7·0	0·76	19	+ 6	4	3·7	—2·8
Midland Counties ...	50·3	—5·7	0·16	4	— 8	2	4·8	—1·2
England, S.E. ...	51·2	—5·9	0·30	8	— 4	3	5·7	—1·0
England, N.W. ...	51·6	—4·2	0·01	0	—12	1	8·8	+2·1
England, S.W. ...	52·5	—3·9	0·08	2	—12	1	7·6	+0·8
English Channel ...	54·3	—3·0	0·06	1	— 9	1	6·7	—1·3
Week ending June 24th:								
England, N.E. ...	54·6	—1·3	0·45	11	0	3	3·3	—2·9
England, E.	55·0	—2·7	0·30	8	— 3	4	3·5	—3·3
Midland Counties ...	55·5	—1·9	0·26	7	— 5	2	3·1	—3·0
England, S.E. ...	55·9	—2·5	0·18	5	— 5	3	4·2	—2·7
England, N.W. ...	55·2	—1·8	0·33	8	— 7	2	4·5	—1·9
England, S.W. ...	54·5	—3·0	0·39	10	— 4	3	5·0	—1·8
English Cha nel ...	56·1	—2·3	0.24	6	— 4	3	5·1	—3·0
Week ending July 1st:								
England, N.E. ..	54·6	—2·8	0·46	12	+ 1	4	3·3	—3·2
England, E.	56·8	—2·7	0·44	11	+ 2	4	3·5	—3·8
Midland Counties ...	55·4	—3·7	0·64	16	+ 4	5	3·2	—3·4
England, S.E.... ...	56·6	—3·6	0·63	16	+ 7	4	4·2	—3·3
England, N.W. ...	55·0	—3·2	0·91	23	+ 8	5	3·4	—3·0
England, S.W. ...	55·5	—3·2	1·14	29	+16	6	5·0	—2·0
English Channel ...	56·6	—3·0	0·40	10	0	4	5·4	—3·0

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	38	32	317	358
Animals attacked	51	38	375	401
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	4	12	25	26
Animals attacked	7	21	69	40
Parasitic Mange:—				
Outbreaks	117	86	1,500	*418
Animals attacked	261	160	3,477	*911
Sheep-Scab:—				
Outbreaks	4	1	177	156
Swine Fever:—				
Outbreaks	459	492	2,615	2,332
Swine Slaughtered as diseased or exposed to infection	1,198	2,438	8,085	10,777

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	—	2	1
Animals attacked	—	—	6	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	8	13	37	36
Sheep-Scab:—				
Outbreaks	13	14	226	254
Swine Fever:—				
Outbreaks	29	19	159	140
Swine Slaughtered as diseased or exposed to infection	196	83	885	822

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in June and May, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	JUNE.		MAY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	16 2	15 2	15 5	14 8
Herefords	15 9	14 7	15 11	14 8
Shorthorns	15 6	14 3	15 4	14 2
Devons	15 3	13 7	15 1	13 5
Welsh Runts	—	14 0	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	13½	12¾	14	11¾
Sheep :—				
Downs	13½	12¼	14	13
Longwools	12¾	11¾	13	12
Cheviots	14¾	13½	14½	12¾
Blackfaced	14½	12¾	14	12
Welsh	13½	12¼	13¾	12¼
Cross-breds	13¾	12½	14	12¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 3	11 5	12 7	11 11
Porkers	13 2	12 6	13 3	12 9
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	33 19	27 3	32 15	26 7
,, —Calvers ...	32 12	25 19	31 7	25 15
Other Breeds—In Milk ...	31 11	24 8	29 7	23 13
,, —Calvers ...	24 0	22 0	19 10	18 0
Calves for Rearing	4 0	3 3	3 8	2 14
Store Cattle :—				
Shorthorns—Yearlings ...	15 5	13 6	15 1	13 1
,, —Two-year-olds...	22 19	19 12	22 7	19 10
,, —Three-year-olds	31 19	26 12	29 17	25 3
Herefords —Two-year-olds...	23 0	19 15	24 0	20 7
Devons— ,,	24 0	19 15	25 2	21 16
Welsh Runts— ,,	23 12	19 13	21 5	19 0
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	65 4	57 8	71 8	63 0
Store Pigs :—				
8 to 12 weeks old	39 11	31 10	37 5	29 5
12 to 16 weeks old	59 0	47 8	56 1	45 0

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in June, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	113 6	113 0	—	111 0	113 0
	2nd	108 6	108 6	—	106 0	106 0
Cow and Bull	1st	104 6	107 6	99 0	93 6	96 0
	2nd	98 0	97 0	82 0	88 6	87 6
Irish: Port Killed	1st	—	—	111 6	106 6	106 6
	2nd	—	—	104 6	102 0	101 6
Argentine Frozen—						
Hind Quarters	1st	98 0	—	—	—	—
Fore "	1st	86 6	—	—	—	—
Argentine Chilled—						
Hind Quarters	1st	100 6	98 6	98 6	98 0	98 6
Fore "	1st	86 6	85 6	84 6	85 0	84 6
Australian Frozen—						
Hind Quarters	1st	—	—	95 0	—	95 0
Fore "	1st	—	—	86 6	—	86 6
VEAL :—						
British	1st	119 0	—	—	126 0	—
	2nd	109 6	—	106 0	105 0	98 0
Foreign...	1st	—	—	—	—	—
MUTTON :—						
Scotch	1st	—	—	119 0	133 6	116 6
	2nd	—	—	107 6	126 0	111 0
English...	1st	129 6	130 6	—	125 0	109 6
	2nd	119 0	121 6	—	116 6	104 0
Irish: Port Killed	1st	126 0	—	107 6	112 0	107 6
	2nd	121 6	—	99 6	102 6	101 6
Argentine Frozen	1st	98 0	101 0	94 6	97 6	94 6
Australian "	1st	—	—	81 6	85 0	81 6
New Zealand "	1st	—	84 0	—	85 0	—
LAMB :—						
British	1st	126 0	135 6	127 0	133 0	128 6
	2nd	119 0	127 0	114 6	122 6	119 0
New Zealand	1st	96 0	95 6	95 6	93 6	95 6
Australian	1st	91 6	—	—	93 6	—
Argentine	1st	121 6	112 6	112 6	115 0	112 6
PORK :—						
British	1st	112 0	106 6	99 0	104 0	88 6
	2nd	108 0	102 6	91 0	94 6	83 0
Frozen	1st	84 0	84 0	80 6	88 0	85 6

AVERAGE PRICES of PROVISIONS and POTATOES at certain MARKETS in ENGLAND in June, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	18 0	17 0	—	—	18 0	17 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	164 0	160 0	163 6	159 6	164 6	160 6
„ Factory	141 6	133 0	142 6	132 6	146 0	136 0
Danish...	—	—	174 0	172 0	176 6	173 6
French...	—	—	—	—	155 0	150 0
Russian	135 0	128 0	—	—	136 6	128 0
Canadian...	—	—	—	—	162 0	159 0
Australian	163 0	159 0	—	—	161 0	157 0
New Zealand	169 6	167 6	—	—	170 0	166 6
Argentine	161 0	157 0	—	—	160 0	156 0
CHEESE:—						
British—						
Cheddar	115 0	112 0	116 0	114 0	115 6	111 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	111 0	107 0	114 6	108 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	103 0	101 0	99 6	96 0	105 0	101 6
BACON:—						
Irish (Green)	111 6	107 6	110 6	106 0	110 0	106 0
Canadian (Green sides)	95 6	93 0	94 6	89 6	98 6	94 6
HAMS:—						
York (Dried or Smoked)	160 0	156 0	—	—	159 6	153 6
Irish (Dried or Smoked)	—	—	—	—	150 0	144 0
American (Green) (long cut)	88 6	85 0	88 6	85 0	89 6	85 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	16 8	—	—	—	17 6	16 5
Irish	16 4	—	15 11	14 11	16 10	16 3
Danish	—	—	—	—	18 10	17 1
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	200 0	180 0	—	—	285 0	266 0
Up-to-date	187 6	167 6	183 6	171 6	245 0	228 6
Other Late Varieties ..	225 0	185 0	196 6	185 0	250 0	240 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.			BARLEY.			OATS.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 8...	30 11	46 2	55 8	25 11	29 7	47 8	18 4	26 5	31 5
" 15...	31 0	48 9	56 7	26 0	30 5	48 6	18 6	27 6	31 11
" 22...	30 11	51 6	57 2	26 3	31 3	49 6	18 11	28 10	32 6
" 29...	31 1	52 8	58 0	26 6	32 5	51 0	19 1	29 10	32 11
Feb. 5...	31 0	53 3	58 3	26 7	33 7	52 5	18 9	30 3	32 4
" 12...	31 0	54 8	57 6	26 7	34 7	52 10	18 11	31 1	32 2
" 19...	31 0	56 0	56 11	26 7	34 11	53 6	18 11	31 5	31 9
" 26...	31 0	56 0	58 2	26 6	35 3	54 2	18 11	31 8	32 2
Mar. 4...	31 5	55 11	59 4	26 2	34 6	55 7	18 9	31 8	32 4
" 11...	31 6	54 8	58 2	26 0	33 5	55 6	18 7	31 0	32 3
" 18...	31 5	53 9	57 9	25 8	32 2	55 4	18 6	30 7	31 10
" 25...	31 4	54 3	55 11	25 7	31 11	54 6	18 8	30 6	31 4
Apl. 1...	31 6	54 6	53 6	25 6	31 9	53 8	18 5	30 6	30 5
" 8...	31 5	54 9	51 8	26 8	31 3	53 7	18 4	30 4	30 1
" 15...	31 7	55 4	53 2	25 4	30 10	53 1	18 4	30 5	30 7
" 22...	31 9	56 5	55 3	26 6	31 5	52 10	18 5	30 11	31 8
" 29...	31 9	58 3	56 3	26 0	32 7	53 5	18 5	31 5	32 4
May 6...	32 2	60 5	55 7	25 6	33 3	53 1	18 9	32 4	32 10
" 13...	32 7	61 7	55 5	26 3	34 0	53 5	18 11	32 5	33 1
" 20...	33 0	62 0	55 0	25 10	34 1	52 10	19 0	32 8	33 0
" 27...	33 9	61 11	54 7	26 1	34 8	52 9	19 4	32 7	33 4
June 3...	34 0	61 9	53 3	25 11	35 4	53 9	19 4	32 5	33 3
" 10...	34 1	60 1	51 2	24 11	34 5	52 8	19 8	32 4	32 7
" 17...	34 1	56 1	48 10	25 10	34 3	50 9	19 9	31 9	32 1
" 24...	34 3	52 0	47 6	25 4	34 4	49 10	20 0	31 9	31 3
July 1...	34 4	49 5	46 3	24 6	35 3	49 1	19 9	31 1	30 10
" 8...	34 2	50 1	46 3	24 9	34 7	45 6	20 0	31 6	30 8
" 15...	34 1	52 7		24 2	35 8		19 10	31 6	
" 22...	34 0	53 10		24 7	35 10		19 9	32 1	
" 29...	34 2	55 3		25 9	36 1		19 8	31 1	
Aug. 5...	34 9	55 4		25 2	35 7		19 1	31 5	
" 12...	40 3	55 2		29 4	37 0		25 1	31 7	
" 19...	38 9	54 3		29 10	39 4		24 3	31 4	
" 26...	36 2	51 11		30 3	38 3		23 5	30 0	
Sept. 2...	36 5	45 3		30 6	38 1		23 9	26 10	
" 9...	37 10	43 0		29 11	37 11		23 11	26 8	
" 16...	38 3	42 9		29 5	39 0		23 8	26 4	
" 23...	37 6	43 3		29 3	39 8		23 3	26 1	
" 30...	37 1	43 5		29 1	40 4		22 9	26 5	
Oct. 7...	36 8	44 1		28 10	41 0		22 5	26 5	
" 14...	36 7	45 9		28 8	42 3		22 4	27 1	
" 21...	37 2	48 2		28 7	44 0		22 5	28 1	
" 28...	37 10	50 3		28 3	46 2		23 7	29 1	
Nov. 4...	38 8	51 6		28 6	47 3		23 7	30 4	
" 11...	39 8	52 8		29 0	47 5		24 8	30 11	
" 18...	41 0	53 6		29 8	47 11		25 5	31 3	
" 25...	41 11	54 2		30 3	48 7		25 8	31 1	
Dec. 2...	42 2	53 7		30 2	48 11		25 9	30 11	
" 9...	42 1	52 10		29 11	47 10		25 9	30 4	
" 16...	42 7	53 11		29 8	47 5		25 9	30 6	
" 23...	43 3	53 10		29 9	47 2		25 11	30 7	
" 30...	44 4	54 9		29 10	47 5		26 6	30 10	

NOTE.—Returns of purchases by weight or weighed measure are converted to

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets **during the Month** of June, 1914, 1915, and 1916.

—	WHEAT.			BARLEY.			OATS.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London ...	35 5	58 5	50 0	24 10	35 1	51 0	20 2	33 5	33 5
Norwich ...	34 1	58 5	49 6	24 9	33 4	48 10	18 11	31 9	31 4
Peterborough	33 5	54 8	47 9	22 2	33 3	48 8	19 1	31 8	31 8
Lincoln ...	34 5	56 2	50 3	23 3	33 8	49 9	20 4	31 4	32 4
Doncaster ...	34 0	54 4	50 1	28 2	—	—	19 8	31 3	31 7
Salisbury ...	33 2	57 4	49 4	22 4	34 8	50 1	19 8	31 8	31 6

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THE IMPROVEMENT OF LIVE STOCK IN ENGLAND AND WALES.*

THE first Report (Cd. 8017) on the operation of the Live Stock Scheme, which was published in July, 1915, contained the regulations governing the award of grants, with so full an explanation of the objects of the scheme that it is unnecessary to repeat these in detail. It will suffice to say that the grants, which are made out of funds provided by the Development Commission, are of the following amounts:—

Heavy Horse Societies—A grant not exceeding £80 (£40 direct and £40 for assisted nominations) in respect of each stallion subsidised.

Bull Societies—A grant of £15 in respect of each bull if provided by a society, and of £12 if provided by an individual.

Boar Societies—A grant of £3 in respect of each boar.

Milk Recording Societies—A grant equal to half the expenses of the society, but not exceeding £50 per 20 herds.

The chief aim of the scheme is to educate breeders to the value of using good sound pedigree bulls, stallions, and boars, instead of the nondescript and unsound sires whose chief qualification has often been the low fees at which their services could be obtained. Financial assistance is also given to dairy farmers to encourage them to keep records of the milk yields of their cows. The scheme is thoroughly practical, as well as educational, as, under it, sires of merit are provided for the use of farmers at low fees by means of grants paid to the owners of the sires. Incidentally, the advantages of co-operation are demonstrated, as the benefits of the scheme are confined almost entirely to farmers who join boar, bull, heavy horse, and milk-recording societies.

* This article constitutes the Report on the Administration of the Grant for the Improvement of Live Stock in England and Wales for the year 1st April, 1915, to 31st March, 1916. For the sake of public economy the usual annual Reports are not at present being issued.

For purposes of administration, the country has been divided into twelve provinces, and in each of these a live stock officer has been appointed. He is attached to a selected agricultural college or institution in the province, and is responsible for the promotion of the scheme in his area. Owing to the fact that these officers are men with much practical knowledge and experience of the breeding of live stock their advice and assistance in the selection, purchase, and care of stock is sought, and increasingly so, by farmers and breeders. In some provinces there was an unavoidable delay in the appointment of live stock officers, and it was explained in last year's Report that there were on this account some districts where the scheme had hardly begun to operate. During the year now under review a fair trial has been given to it, and, as far as can be ascertained at present, the scheme has been favourably received on the whole, is working satisfactorily, and if continued for a long enough period of years it promises to have a very beneficial effect on the live stock of the country, especially on that bred by the small farmer and small holder.

In most provinces some counties are more eager than others to avail themselves of the grants. In the backward counties, where the live stock is in greatest need of improvement, it is usual to find the greatest difficulty in getting the scheme taken up, and if grants had not been reserved for such districts more rapid progress could have been shown in the more progressive counties. Particulars of the grants authorised for each province and of the number of animals actually subsidised are given in the Appendix on p. 425.

It should be remembered that the scheme is only in its infancy. No sires were provided under it till February, 1914, and, except for the first seven months of its existence, it has had to contend with war conditions. Many of the young and most progressive farmers and farmers' sons have joined the army; labour has been scarce on most farms; feeding-stuffs for stock have been dear to buy, and at times difficult to obtain, and, with the increase in the price of meat, the price of bulls has gone up. In spite of these drawbacks every branch of the scheme has made considerable and steady progress, and the number of sires provided in 1915-16 shows a considerable increase on that for 1914-15, as will be seen from the comparative table on p. 419.

The progress made in little more than two years is encouraging. Many years must, however, elapse before the object of the scheme is likely to be secured, as farmers will not be convinced, except by practical results, that it is a paying

proposition and commercially sound to use high-class sires whose service fees are double, or even five times as much as those that they have been in the habit of paying in the past. When farmers, who are members of bull, boar, or heavy horse societies, find that their young stock mature earlier and grow into more money than those got by nondescript sires, then, and not till then, will the benefits of the scheme be fully realised and valued.

The assistance given to live stock officers by members of the provincial and county live stock committees has been of considerable service in the promotion of the scheme, and the thanks of the Board are due to them, and especially to the chairmen of the county committees, for their active co-operation and help.

Year.	Boars.		Bulls.			Horses.		Milk Recording.	
(1st April-31st Mar.)	No. of Societies.	No. of Boars.	No. of Societies	No. of Individual Owners.	No. of Bulls.	No. of Societies.	No. of Stallions.	No. of Societies.	No. of Cows.
1914-15 ...	100	107	285	26	370	65	72	16	7,331.
1915-16 ...	180	193	489	28	633	88	97	20	9,811

Grants for Bulls.—No part of the live stock scheme has been more keenly taken up and appreciated than the bull section. The number of applications for grants has considerably exceeded in some provinces the number of grants available, and therefore the opportunity has been taken to exercise careful discrimination in the selection of societies and sires. There has been also a gradual weeding out of sires which were not considered to be up to standard. In some cases, too, societies which were somewhat hurriedly formed when the scheme first came into operation have not proved altogether satisfactory, and these have been reconstituted on a sound basis or the grants have been transferred from them to more promising societies.

The number of bulls located at the close of the year 1915-16 was 633, of which 605 were provided by 489 societies, and the remainder by 28 individual owners. Of these bulls, 461 were located in England, and 172 in Wales. The number of bulls actually purchased and owned by societies was 73, the other 532 being hired by societies from bull owners.

The number of bulls located in each province varied considerably, as will be seen on reference to the Appendix, but this is to be expected as in some counties—such as Cumberland and Westmorland—the supply of good bulls is large and there is little need of Government assistance.

The popularity of the Shorthorn is evidenced by the fact that of the 633 bulls subsidised, 425 are of that breed. The other breeds are Hereford (70), Lincoln Red (47), Welsh Black (35), Devon (34), South Devon (15), Aberdeen Angus (5), one Jersey and one Guernsey.

The Shorthorn also showed the highest average price with £41. Lincoln Reds and Herefords averaged approximately £40, Devons £39, and Welsh Blacks £28. The average price of all the subsidised bulls was approximately £40.

The service fees of these bulls varied from 2*s.* 6*d.* to 7*s.* 6*d.* At the former figure, 267 bulls were serving; a charge of 3*s.* was made in respect of 100 bulls, and one of 5*s.* for 134 bulls.

It is too early yet to estimate the general effect of the provision of good bulls, but evidence is available that the value of the calves sired by the subsidised animals is usually higher than that of calves got by non-pedigree bulls, and little difficulty is apparently experienced by members of bull societies in disposing of their calves for rearing, and the demand for the heifer calves is much greater than the supply.

Numerous instances have been reported of farmers who are buying a few pedigree cows now that good sires are available to serve them, and at a recent sale of a well-known pedigree herd of shorthorns, 16 animals (2 bulls, 11 cows, and 3 calves) were purchased by members of subsidised societies who, in the opinion of the live stock officer in the district, would have been unlikely to attend the sale if the live stock scheme had not been in existence.

Other indirect and beneficial results of the operation of the scheme may be noted. In some districts where bull societies exist, farmers, who have been for years in the habit of keeping indifferent sires, are now buying good pedigree ones, as they do not like to keep bulls which are inferior to those which their smaller neighbours are now using.

Breeders of pedigree cattle are beginning to realise that the live stock scheme is creating an additional home market for pedigree stock, and they may be relied on to cater for it. In this connection it is interesting to note the following extract from an article in Volume 6 of the Welsh Black Cattle Herd Book, which was recently issued: "It is significant that there should be such a large number of entries for the present Volume of the Herd Book, which appears at a time when there is likely to be a demand for well-bred bulls for the purposes of the live stock scheme of the Board of Agriculture and Fisheries. It is scarcely too much to say that there never has been anything

so far in the history of Welsh Black Cattle that has done more than the live stock scheme has done to bring home to the ordinary breeder the necessity for systematic effort in breeding if the breed is to have a future."

It is evident, therefore, that the bull scheme, though it has been in operation little over two years, is having direct and indirect beneficial effects which must in the course of time tend to improve the cattle-breeding industry of the country.

Grants for Boars.—There were 193 boars subsidised in 1915-16, being an increase of 86 on the number located in the previous year. The progress in this section of the live stock scheme for the year under review is not altogether unsatisfactory when the difficulties of forming societies are taken into account and allowance is made for the war conditions that prevail. In some provinces there is apparently little demand for good boars, and great difficulty is experienced in persuading small pig-breeders to form societies to take advantage of the offer of the £3 grants for the provision of boars. In two or three provinces, however, this part of the scheme is fully appreciated, and the grants are much sought after and taken up.

Of the 193 boars located, 91 were Large Whites, 43 Large Blacks, 18 Gloucestershire Old Spots, 15 Berkshires, 14 Middle Whites, 10 of the Lincoln Curly Coated Breed, and 2 Large White Ulster, and the average price was £7 *12s. 6d.* per pig.

The service fees varied from *5s.* down to *1s.*; the most popular fee was *2s. 6d.*

The insistence of the Board in refusing to make grants in respect of non-pedigree boars has resulted in the establishment of herd books for two well-known breeds of pigs, the "Gloucestershire Old Spots," and "The Cumberland," which are to be found chiefly in the counties from which they take their names, and in counties adjoining them. The value of pigs of these breeds will be enhanced when entered in herd books, and the demand for them is likely to be increased.

Grants to Heavy Horse Societies.—Satisfactory progress has been made with this part of the live stock scheme—the number of societies operating in 1915 being 88 with 97 stallions, as compared with 65 societies and 72 stallions in 1914—and 62 of the 88 societies have been formed since the scheme was initiated in 1914.

A heavy horse society covers, as a rule, a comparatively large area, and includes in its membership many of the leading and larger agriculturists of the district, and the success of these societies and the example of prominent farmers have doubtless

encouraged the smaller farmers to join local bull and boar societies.

The number of mares served by the 97 subsidised stallions was 9,122, an average of 94 mares per horse. Assisted nominations, that is to say, payments not exceeding half the normal service fee, were made by the Board in respect of 2,430 of these mares which belonged to farmers whose holdings did not exceed 100 acres.

The average hiring fee paid for these stallions was £241, and the average service fee approximately £2 10*s*.

In Cumberland and Westmorland somewhat different procedure has been followed from that adopted in the rest of the country. The live stock committees in these two counties made representations to the effect that the number of good, sound stallions travelling in their districts was sufficient, and that the funds authorised should be utilised solely in the award of assisted nominations for the service of mares belonging to small farmers of 100 acres or under. The Board approved of the proposal, and a society was formed whose operations covered the two counties. Committees were appointed to inspect and select stallions for the service of mares. The service fees of these stallions varied from two to three guineas, the average fee working out at £2 7*s*. Assisted nominations—*i.e.*, half service fees—were paid in respect of 385 mares which were served by 52 selected stallions, and, thanks to the energy and activity of the members of the selection committees and of the secretary of the society, the arrangements were well carried out, and should prove of considerable benefit to small farmers, as they were enabled to secure the use of better horses than they had been previously accustomed to do.

The approval of sires is left to the selection committees of the societies, and in some few instances it is open to question whether full value is obtained for the hiring fees paid. There is, however, no doubt whatever that the majority of the members of these societies are getting better value for the money expended by them in service fees than they did previously, when they made their own selection of stallions, which, as a rule, depended more on the amount of the service fee than on soundness, pedigree, and conformation.

The scheme has already done much to educate mare-owners to the advantage of combining in order to secure a stallion that is certified sound, is well bred, and of good make and shape. The provision of subsidised stallions, and the scheme under which stallions are registered as sound by the Board are

reducing the number of unsound tramp stallions, and, in course of time, should drive them off the road. Farmers are realising more than they did formerly the advantages of using sound sires, and they now hesitate to use a stallion unless certified sound.

However many rosettes a stallion may win in the show-ring, the qualification that most concerns the mare-owner is that of foal-getting, and it is on this most important point that the Board endeavour to obtain information in regard to the stallions recommended for grants. Considerable difficulty, however, has been experienced in getting accurate foal returns, and though the secretaries of the societies take active steps to secure the particulars desired in regard to subsidised sires they often fail to do so because mare-owners will not take the trouble to reply to the enquiries made. Mare-owners often fail to realise their responsibility in the matter, and appear to forget that the information is being collected for their benefit, as no grant is made in favour of a stallion—however good a show-horse he may be—if his foaling record over a period of two consecutive years is a bad one. Payment by results, the system which to a great extent is followed in Scotland and the North of England, has much to commend it, and the adoption of it in England is well worthy of consideration by horse societies in making their agreements with stallion owners.

Milk Recording Societies.—The milk-recording section of the scheme cannot make much headway under present conditions. Even in normal circumstances farmers are generally loth to embark upon a scheme which is new to them, and of which the financial benefits are not at once apparent. Farm labour is scarce, and, as was pointed out in the Report for last year, many of those most likely to be interested in the scheme, and to make it a success, joined the army in the early stages of the war. Satisfactory recorders are increasingly difficult to secure, and in some cases societies have been badly served in this respect, and, in consequence, have not met with very encouraging success. It is satisfactory, however, to record that notwithstanding these difficulties the number of societies has shown a slight increase during the year, and that all the societies that were in existence at the beginning of the year covered by this Report are still "carrying on." In the case of those societies who have had good recorders the results of the year's working have been generally satisfactory, and there is every reason to hope that when conditions are less abnormal the results of this important part of the live stock scheme will fully justify the efforts which are being made to secure its adoption.

The ultimate success of the scheme must depend on the commercial advantage to be obtained from it, and it is satisfactory to be able to report that a member of a milk-recording society, who disposed of his herd last November, estimated that the possession of the milk-record certificates for his cows, which had been issued by the Board, and which were handed round at the sale, had the direct result of increasing the prices made by quite £200 over what would have been paid for his cows if they had not been sold with the Board's certificates.

Several other cases have been brought to the Board's notice of the commercial value of a milk-record certificate. Bull calves, out of cows with good *certified* records have made from £5 to £10 more than their ordinary value. An offer of 50 guineas each for two in-calf non-pedigree cows, whose records were 800 and 900 gal., respectively, was recently refused by a member of a milk-recording society. Another society reports: "There has been a splendid sale of bull and heifer calves from milk-record cows; forty enquiries for calves were received as the result of an advertisement in an agricultural paper."

The number of certificates issued during the year was 637, and the demand for them came, as was to be expected, chiefly from the most progressive of the societies. A large number of the certificates issued were in respect of cows with milk records of over 700 gal., and one cow, whose records were taken daily, gave 1,774 gal. in the year. There is no doubt the demand for certificates will increase considerably when their commercial value becomes more widely known and appreciated.

Several milk-recording societies have started registers of calves out of recorded cows. These calves are tattooed in their ears when a few days old with permanent identification marks, and particulars of their breeding and of the milk yields of their dams are recorded in the register. By this means a purchaser of these calves, either when young or full-grown, is able to form some idea of their suitability for a dairy herd, instead of judging, as is now usually the case, merely by inspection, which by itself affords an unreliable guide in the selection of young stock for dairy purposes.

The number of milk-recording societies in operation at the end of the year now under review was 20, as compared with 16 in the previous year. There were 350 members, and they owned 398 herds numbering, approximately, 9,800 cows. The increase in the number of societies, members, and herds, is not large, but in these abnormal times even a slight increase suggests a

not unfavourable outlook for the formation of milk-recording societies after the war.

The accounts of these societies, which have completed a year of operations, show that the average cost to a member is less than 2*s*. per cow recorded, exclusive of the initial cost of purchase of weighing balances and other equipment of a permanent nature which may be regarded as capital expenditure.

When the financial value of a milk-recording certificate is realised and appreciated an annual outlay of 2*s*. per cow should be considered a really good investment, and will, in time, no doubt be regarded as such, and tend to a steady development of milk-recording under this section of the live stock scheme.

The following are the principal memoranda and forms used in connection with the live stock operations of the Board, and copies of them can be obtained free of charge on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.—

- L[1]. Memorandum on the Live Stock Scheme.
- L[2]. Regulations as to Bull Grants.
- L[3]. Regulations as to Heavy Horse Grants.
- L[4] and L[79]. Regulations and memorandum as to Milk Record Grants.
- L[11]. Regulations as to Boar Grants.

APPENDIX.

List of Grants which were Authorised, and the number of Sires and Milk Recording Societies which were Subsidised in the Year from 1st April, 1915, to 31st March, 1916.

Province.	Boars.		Bulls.		Horses.		Milk Recording.		Total Authorised for Province.
	Amount Authorised.	Sires Subsidised.	Amount Authorised.	Sires Subsidised.	Amount Authorised.	Sires Subsidised.	Amount Authorised.	Societies Subsidised.	
	£		£		£		£		£
1. Armstrong College ...	40	4	305	14	826	*5	250	2	1,421
2. Manchester University	48	2	1,393	45	480	1	500	1	2,426
3. Leeds University ...	80	15	1,094	71	870	12	400	nil	2,444
4. Harper Adams College	60	14	1,107	46	480	10	400	nil	2,047
5. Midland College ...	64	16	1,080	68	720	6	400	4	2,264
6. Cambridge University	212	7	1,218	26	1,760	10	450	4	3,640
7. South-Eastern College	56	10	678	21	400	4	250	1	1,384
8. Reading College ...	188	23	918	41	740	9	400	2	2,246
9. Bristol University ...	118	45	1,495	90	1,033	14	600	5	2,246
10. Seale-Hayne College	60	7	1,058	39	560	5	400	nil	2,078
England	926	143	10,351	461	7,869	76	4,050	19	23,196
11. Aberystwyth College .	108	31	1,575	101	960	12	484	1	3,177
12. Bangor College ...	80	19	1,125	71	720	9	352	nil	2,277
Wales...	188	50	2,700	172	1,680	21	836	1	5,404
England and Wales	1,114	193	13,051	633	9,549	97	4,886	20	28,600

* Exclusive of the Cumberland and Westmorland Society.

THE RECENT DEVELOPMENT OF GERMAN AGRICULTURE

IN a Parliamentary Paper* which has recently been issued by the Board of Agriculture and Fisheries an account is given of the recent development of German agriculture. The memorandum covers 74 pages, and represents an attempt to explain why it is that in recent years German agriculture has made such a rapid advance, while in England the production of food from the soil has decreased. It is prefaced by the following note, dated 1st June, 1916, by Lord Selborne, then President of the Board of Agriculture and Fisheries:—

"*It has been part of my duty at the Board of Agriculture* and Fisheries to make a study of the agriculture of Germany, and in the course of my work it became apparent to me that, if agriculture had made no more progress in Germany than it has in the United Kingdom during the period 1895 to 1915, the German Empire would have been at the end of its food resources long before the end of the second year of the war, and that, as a matter of fact, the war was being fought by it just as much on an agricultural as on a military organisation of the nation."

"Accordingly, I asked Mr. T. H. Middleton, C.B., of this Department, to prepare a paper showing what had been the development of German agriculture in the last thirty to forty years and how that development has been accomplished. This admirable memorandum is the result. I respectfully commend it to the attention of Parliament, the Press, and the public."

In his memorandum Mr. Middleton remarks that it is frequently stated and commonly believed in this country that British farming is the best in the world. It is certain that throughout the 19th century we led other nations. An interesting communication to the old Board of Agriculture contrasts the backward state of German agriculture with the condition of our own at the end of the 18th century; and at the dawn of the 19th, the first work published by Von Thaer, who initiated the development of German agriculture, was entitled "An Introduction to the Knowledge of English Agriculture; containing the latest Practical and Theoretical Intelligence with a view to the Improvement of German Agriculture."

The criterion of good farming in this country at the end of the

* "The Recent Development of German Agriculture," by T. H. Middleton, C.B., Assistant Secretary, Board of Agriculture and Fisheries (Cd. 8305, Price 4*d*.)

18th century was success in food production. During the 19th century, since we were not dependent on the products of our own soil, the agriculturist's ideals have been modified, and if it be agreed that our claim that British farming is the best means that at the present time we can show very fine cultivation and a high yield per acre of certain crops, that we can produce the best specimens of a large assortment of breeds of live stock and secure for them higher prices than any other country, and that the ordinary machines and implements which we employ are, as a rule, better constructed than those used by farmers in other countries, then British farming undoubtedly still takes a very high place, and is probably second to none; but if we return to the criterion of success accepted by our own old improvers of husbandry, from whom Von Thaer learned—the amount of the production of food from our soil—then it must be admitted that our position is no longer satisfactory.

Proceeding to deal with the reasons for the great improvement in German agriculture during the past thirty or forty years Mr. Middleton (1) examines some figures bearing on production in Germany in the past 40 years; (2) contrasts the main conditions under which German agriculturists and our own farmers work; (3) refers to the organisation of German agriculture; (4) discusses the effects of German economic policy on the progress of German agriculture; (5) indicates the methods by which the German farmer has succeeded in providing food for the rapidly growing population of the Fatherland; and (6) notes some lessons to be learned from Germany.

An examination of the figures relating to production has led Mr. Middleton to conclude that the following statements would appear to be justified:—

On each hundred acres of cultivated land*:—

(1) The British farmer feeds from 45 to 50 persons, the *German farmer feeds from 70 to 75* persons.†

(2) The British farmer grows 15 tons of corn, the German farmer grows 33 tons.

(3) The British farmer grows 11 tons of potatoes, the German farmer grows 55 tons.

(4) The British farmer produces 4 tons of meat, the German farmer produces $4\frac{1}{4}$ tons.

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* Cultivated land includes arable and grass land, but excludes the "Mountain and Heath Land used for Grazing" of Britain and the corresponding "Geringere Weiden und Hutungen" (poor pastures) of Germany.

† These figures are based on the estimate that, of the total "energy value" of food consumed, Great Britain imports on the average about 60 per cent., and that Germany imports 10 per cent. A detailed German estimate is given in the memorandum.

(5) The British farmer produces $17\frac{1}{2}$ tons of milk, the German farmer produces 28 tons.

(6) The British farmer produces a negligible quantity of sugar, the German farmer produces $2\frac{3}{4}$ tons.

It is shown that the area of cultivated land in Germany has slightly decreased in recent years. The reclamation of moorland, about which we hear much, is interesting as an indication of agricultural energy, but it counts for little in the feeding of the German people. The agricultural population has remained practically stationary. Rather less than more labour is being employed now than 25 years ago. It is, indeed, evident that the larger production has not been due to an increase in the area tilled, or to an increase in the number of persons engaged in tillage, but to better farming; the soil has been better cultivated, crops have been more skilfully manured, plants and animals have been improved in type; the use of oil-cakes and other feeding-stuffs has increased; sanitary laws have led to a great improvement in the health of farm live stock. Side by side with these improved technical methods improved business methods have been resorted to, and the profits of agriculture have in turn been employed in further developing the means of production.

A very great deal is clearly shown to be due to the system of agricultural education, an account of which is given; and the following observation by Mr. Middleton almost certainly applies to other agricultural questions besides manures:—"The chief factor in developing the use of artificial manures in Germany, however, was unquestionably a well-organised system of technical education. Investigation at the research stations established the precise uses of these manures; trustworthy advice was supplied by institutions, by peripatetic instructors, by technical leaflets and by agricultural newspapers; and the farmer, even the backward *Bauer*, like other Germans, brought his methods into line with 'Authority.'"

Touching on lessons which may be learned from a study of the progress of German agriculture, Mr. Middleton concludes:

1. The German farmer now produces about the same weight of cereals and potatoes per acre as the British farmer; but a much greater weight per 100 acres of cultivated land. The German produces about the same weight of meat and nearly twice as much milk per 100 acres as the British farmer. The German feeds from 70 to 75 persons per 100 acres of cultivated land, the British farmer feeds from 45 to 50.

2. The ascendency of the German has been gained in the past 40 years.

3. The soil and climate of Germany are less favourable to agriculture than those of Britain.

4. The actual methods of tillage adopted in the growing of corn, potatoes, etc., in Britain are not inferior to the methods adopted in Germany. The difference in production is chiefly due to the circumstance that in Britain more than two-thirds of the cultivated land is now in grass, while in Germany less than one-third of the cultivated land is in grass. There has been a slight decrease in the area annually ploughed in Germany; in England and Wales the area which is annually ploughed decreased by about 26 per cent. in the forty years before the war.

5. A comparison of the main features of the agriculture of the two countries is given largely in the form of tabular statements. It is pointed out that German land is mostly tilled by peasant owners, British land by tenants. The German depends to a great extent on women labour, provided by the families of the occupiers. Wages are relatively low in Germany, and rural industries help to provide winter employment and tend to cheapen summer labour.

6. Much attention has been given to organising production from German soil. The credit system is well adapted to promote good farming. Co-operation is largely resorted to. Education has been well developed. Societies have been created to provide leadership.

7. German economic policy in recent years has favoured agriculturists, who have benefited partly from the higher prices resulting from tariffs and partly from the steadying effect which the known policy of the State has had upon the industry.

8. The general effect of the agencies and influences mentioned in the two preceding paragraphs has been to produce a very rapid improvement in the technical methods of the German farmer; the use of manures and feeding-stuffs has greatly increased. Superior strains of both plants and animals have been raised. Business methods have been introduced and important rural industries have been developed.

Mr. Middleton feels that his account of the rapid progress of the German agriculturist may perhaps give the impression

that he is now much more skilful than the British farmer, and is careful to point out that such a conclusion would not be fair to the latter. In some respects the German does his work better; notably, he resorts very freely to co-operation, and thus the peasant is enabled to buy and sell as advantageously as the large farmer; again, though the German peasant is neither scientific in his methods nor teachable, he has more regard for "authority" than the English farmer, and adopts the advice provided for him by chambers of agriculture and societies. Mr. Middleton finds no reason for discouragement with our own position. We have not lost the art of good husbandry, but have modified our methods for reasons sufficiently obvious, and, if after the war the British people make a new demand upon the farmer, Mr. Middleton sees no reason to suppose that he will fail. If, however, the farmer is called upon to modify the methods which have been forced upon him since 1879, by the loss of capital and the relatively high cost of labour, there must be a change in the policy of the country.

The clear lesson which we may learn, if we wish to learn, from German experience is that if we desire to make any considerable addition to our home-grown supplies of food we must as a nation adopt the old farming motto "Speed the Plough."

In the memorandum an attempt has been made to indicate the factors which have been responsible for the success of the "plough" policy of Germany. Among them all Mr. Middleton points out that two are fundamental. Without security for capital and sufficiency of labour the extension of arable farming is not possible. This is in one sense a truism, but behind the truism there are points which are often forgotten and for which provision must be made in any policy that seeks to develop food production.

"If one attempts to summarise in a paragraph the impressions produced by a study of the recent progress of German agriculture, the conclusion is that from the agricultural policy of Germany we may learn something, and from the admirable machinery—administrative, educational, and commercial—set up to lead, teach and finance agriculturists we may learn much. On the other hand, from the actual processes of German husbandry there is relatively little to learn. In many parts of Britain the tillage of the soil and the management of stock are as good as anywhere in Germany. When we set about increasing the food supply of the country we may find examples of the necessary methods without looking across the Rhine."

THE EAST ANGLIAN MILK RECORDING SOCIETY.

J. B. CHEVALLIER, M.A., J.P., C.C. (*Chairman*), and
A. W. OLDERSHAW, B.Sc. (Edin.), N.D.A. (*Hon. Sec.*),

East Anglian Milk Recording Society.

Constitution, &c., of the Society.—The first meeting of the Society was held in June, 1914, when the model rules of the Board of Agriculture were adopted and a milk recorder, Mr. John Bewley, C.D.A. (Durham), was appointed.

The yearly subscription was fixed at 2*s*. 6*d*. per member; the first levy made was 1*s*. per cow, but later in the year it was found necessary to ask for a second levy of 1*s*. per cow—the minimum levy being fixed at £1 per member. These levies were paid, in addition to the annual subscription, by each member.

The East Suffolk County Education Committee made a grant of £10 towards the cost of stationery, postage, etc., whilst the East Suffolk County Council permitted the Society to have the use of a room for milk testing in a house adjacent to the county buildings.

The members of the Society were scattered over a very wide area, within a radius of about 30 miles of Ipswich. According to the rules of the Board the milk recorder must pay a surprise visit to each herd at least once in every 6 weeks; this entailed an average of from 60 to 70 miles cycling weekly on the part of the recorder.

The commencing salary of the recorder was £75 per annum, the recorder paying his own travelling expenses, board and lodging. It was soon recognised that this salary was insufficient and it was increased to £100 per annum. The recorder found his own lodgings in the vicinity of the herds of members.

Ear-marking of Cows.—The Board informed the Society that the letter "K" had been allotted to them as a distinguishing mark. The cows were ear-marked by means of a tattooing instrument as directed by the Board.

Testing of Milk.—Samples of the mixed milk of the herds were taken on each evening and morning of the recorder's visit. These samples were tested free of charge to the members; a fee of 3*d*. per sample was charged for any additional samples tested.

The bottles to contain the samples were purchased of such a size as to enable them to fit in a cardboard egg case of the type used for sending eggs by post. The milk was preserved till the Saturday of each week by means of a small crystal of

potassium bi-carbonate. The milk was tested by the recorder every week-end by means of a 16-test Gerber tester which was purchased by the Society.

Herds Kept.—At the commencement of the first year of the Society's operations there were 21 members with 25 herds.

The herds kept might be roughly divided into two classes—purely commercial herds kept with the sole object of milk production, the cows being of a mixed type, and herds of pure-bred cattle where breeding for milk production was an important object.

Amongst the herds of the members of the Society there were four of Red Polls, two of Jerseys, and two of British Holstein-Frisian cows. The remainder of the herds, 17 in number, were mixed, with a good percentage of Holstein and Red Poll cows and a fair percentage of Shorthorns.

Many of the cows of these breeds were not pedigree, but were of the types of the breeds mentioned.

At the first visit of the recorder 695 cows were ear-marked. A number of cows came into each herd during the year, whilst a number were sold or died.

Of the original members two sold one herd of cows each during the year, whilst two others resigned their membership of the Society at the end of the year, one of these owing to absence on military service, the other to the refusal of the Society to recognise the accuracy of the records of the member in question. The number of cows on the Society's books at the end of the year was 609.

Effect of the War.—The Society may regard itself as fortunate in having started and being in working order a month before the declaration of war. Not the least misfortune which it has incurred therewith is the loss (it is hoped only temporarily) of Mr. Bewley, the milk recorder, who, after 12 months' valuable work, considered it to be his duty to enlist in his country's service. His place has been filled by Mr. F. F. Frost.

Some members of the Society have joined the Forces, and others have suffered from shortage of labour, so that some allowance must be made for gaps in the details required for a complete report at the end of the recording year.

A summary of the returns has been tabulated (see p. 435), showing, as far as possible, the breeds, ages, milk records and butter-fat averages of the various herds. It will be seen that in certain cases no returns have been made as to breed or age of cows. These are omissions that may be expected to disappear

in more peaceful times, and when members realise that much valuable information may be gained for dairy farmers by their inclusion.

The necessity for the exercise by the farmer of careful supervision is shown by the fact that the records of one herd were not accepted by the Board of Agriculture and the Society because they showed persistent irregularity. In this connection, cases have come under notice where the farmer has paid 8*s.* per annum for the work of keeping the records with an additional 1*s.* per cow per annum for the work of casting the figures. Now that education embraces all classes of agriculturists it may be hoped that the cowmen will be able not only to record the figures, but also to fill in the prescribed forms. Such proficiency would betoken skilled work, and would deserve recognition.

If some of the cows are weeded out which during the past year have given under 6,000 lb. of milk, certain members will not regret the trouble which they have taken.

A summary of the receipts and payments is appended.

Receipts.

	£	s.	d.
Members' annual subscriptions	3	0	0
Levies from members, 685 cows at 2*s.* ..	68	10	0
Levies on account, 1915–16	1	11	0
Grant from Board of Agriculture	50	0	0
Grant from East Suffolk Education Committee	10	0	0
Miscellaneous	0	12	2
	£133	13	2

Payments.

	£	s.	d.
Salary of Recorder ..	96	14	8
Insurance of Recorder	0	17	6
Milk-testing apparatus purchased	11	1	1
Furniture for milk-testing room ..	1	14	5
Advertising, etc. ..	1	6	3
Cleaning milk-testing room	1	8	6
Stationery, printing, postage, etc. ..	10	17	6
Balance	9	13	3
	£133	13	2

Rations Fed by Members.— One of the most useful functions which can be performed by a milk recording society is that of carefully weighing the food fed to the cows of the various members.

Work of this character has been performed during both the first and second winters of the Society's existence. The rations have then been carefully considered by the recorder and the honorary secretary of the Society (who is also County Agricultural Organiser). The composition of each ingredient of the rations was taken as that given in the Board's Leaflet No. 79, and the total quantity of digestible albuminoids and the starch equivalent of the ration in pounds were thus calculated. These

figures were forwarded to each member with observations and a statement as to whether the ration came up to the requirements of such cows, according to the standard laid down in the Board's leaflet: *i.e.*, about 12 lb. starch equivalent, including 2 lb. digestible albuminoids, for cows giving 2 gal. of milk and weighing 11 cwt., with an increase (or decrease) of 2 to 3 lb. of concentrated foods for each gal. of milk above (or below) the 2 gal. given by the cow.

The following are instances of rations fed by members:—

		Daily Ration of Cows in February, 1915. *lb.*
Herd 20	Mangolds	70
	Bean meal	$2\frac{1}{2}$
	Compound cake	$1\frac{1}{2}$
	Decorticated cotton cake	2
	Meadow hay	12
	Oat straw	12

This ration would contain about $2\frac{1}{3}$ lb. of digestible albuminoids and its starch equivalent would be about 15 lb. The cows were giving about 2 gal. per head per day at the time. It was suggested that the $1\frac{1}{2}$ lb. of compound cake might be dropped, as an experiment, to see whether its omission would have any effect on the milk yield or the appearance of the cows.

		Daily Ration of Cows in February, 1915. *lb.*
Herd 21	Wet grains	56
	Meadow hay	10
	Mangolds	35
	Decorticated cotton meal	4
	Treacle	3

This ration would contain about $4\frac{1}{5}$ lb. of digestible albuminoids, and its starch equivalent would be about 18 lb. It was considered that the ration was excessive for any except the best cows. After considering its composition, the owner of the cows reduced it to some extent, except in the case of his best cows, and no appreciable reduction in milk yield followed.

		Daily Ration of Cows in February, 1916. *lb.*
Herd 10	Bean meal	4
	Compound cake	4
	Bran	2
	Roots	24
	Chaff	4
	Long hay	7

SUMMARY OF RETURNS.—*Year commencing 28th June, 1914, ending 27th June, 1915.*

Herds. §	No. of Cows.	BREEDS. Shorthorn.	Red Poll.	Jersey.	British Holstein.	Crossbred.	Undescribed, mainly mixed.	AGE. 1 Calf or 3 Years Old.	4 Calves or 6 Years Old.	Aged.	Undescribed.	Records Taken.	Cows giving per annum 10,000 lb.	8,000 lb.	6,000 lb.	4,000 lb.	Under 4,000 lb.	Incomplete.	Butter-fat average. No. of Tests.	P.M.	A.M.
1.	9	1	4	—	1	3	—	2	5	2	—	Week	—	1	3	5	—	—	4	4·4	3·7
2.*	44	—	—	—	—	—	44	—	—	—	44	Week	—	—	—	13	31	—	5	3·7	3·3
3.	15	—	15	—	—	—	—	3	7	5	—	Day	—	1	9	3	1	1	—	4·5†	3·7†
4.	61	—	—	—	—	—	61	—	—	—	61	Day	—	3	28	24	6	—	6	3·8	3·3
5.	26	—	—	1	24	1	—	5	11	10	—	Week	1	7	11	4	3	—	5	3·8	3·3
6.	29	—	—	—	—	—	29	—	—	—	29	Week	—	2	8	11	8	—	4	4·0	3·4
7.	36	—	—	—	—	—	36	—	—	—	36	Week	—	5	5	7	8	11	6	4·3	3·5
8.	36	23	1	—	—	3	9	—	—	—	36	Week	—	3	13	16	4	—	7	3·9	3·2
9.	27	—	—	—	—	—	27	4	—	—	23	Week	2	8	6	6	5	—	6	3·8	3·3
10.	20	—	12	—	8	—	—	6	10	4	—	Day	—	—	6	10	4	—	6	4·4	3·7
11.	46‡	8	—	3	33	2	—	8	37	1	—	Day	8	9	7	9	7	6	5	3·7	3·2
12.	21	—	—	21	—	—	—	—	13	8	—	Week	—	—	6	11	1	3	3	6·2	5·8
13.	10	—	—	10	—	—	—	3	7	—	—	Day	—	—	3	2	1	4	3	6·3	5·6
14.	44	—	—	—	—	—	44	6	9	1	28	Week	1	6	14	9	5	9	5	4·2	3·4
15.	36	—	—	—	—	—	36	10	7	3	16	Week	—	6	13	10	2	5	8	3·9	3·3
16.	10	—	—	—	—	—	10	—	1	6	3	Week	1	1	5	2	1	—	5	4·4	3·7
17.	28	—	21	—	—	—	7	3	15	6	4	Day	—	—	—	16	4	8	6	3·7	3·2
18.	28	—	6	—	—	22	—	—	—	3	25	Day	—	4	16	3	—	5	7	4·1	3·4
19.	40	—	40	—	—	—	—	11	10	13	6	Week	—	—	2	30	6	2	4	3·8	3·3
Totals	566	32	99	35	66	31	303	61	132	62	311	—	13	56	155	191	97	54	Average	4·2	3·6

* Only 9 months recorded. † *Butter-fat* average of individual cows. ‡ 5 cows killed.

§ Particulars are not available for the remainder of the herds owing to unavoidable causes, such as the sale of the herd before the expiration of the year (in two cases), the absence of owner on military service and consequent difficulty in obtaining complete figures (in three cases).

The cows went out every day into a good meadow. As they began to shrink in milk the bean meal and compound cake were reduced by degrees. The cows gave exactly 2 gal. per day when visited by the recorder. The ration works out at not quite 1*s*. 3*d*. per day, the cost of food per gal. of milk produced being not quite 7½*d*.

When calculated out, this ration contains almost exactly the quantity of nutriment suggested in the Board's leaflet for cows giving 2 gal. of milk. It may be mentioned that the cows are Red Polls and Holsteins, and that they looked well.

In several herds the cows have received very scanty rations from time to time—partly, no doubt, owing to the dearness of feeding-stuffs and the difficulty of obtaining supplies owing to the war. These rations have not infrequently been much below the standard given in Leaflet No. 79.

The results of investigations as to rations have been communicated to the local press from time to time, and it is hoped that, by thus giving publicity to the results, the Society, in addition to helping the members to select their cows and feed them cheaply, will also be of some use to all owners of milking herds in the neighbourhood.

If immediate publicity is given to the results of inquiries as to rations there appears to be no reason why the information so obtained should not be of much use to the general body of dairy farmers, and this forms an excellent argument in favour of milk record societies.

Practical Use of Milk Recording Societies to Farmers.—The experience of the Society goes to show that the following are a few of the ways in which a milk recording society may be of value to dairy farmers:—

(1) It enables them to eliminate unprofitable cows from their herds.

(2) It provides a Government certificate of milk yield, and in this way enables purchasers of cows (or young stock from the herd) to place absolute confidence in the accuracy of the records given.

(3) It enables the farmer to have samples of his milk taken and tested at frequent intervals, so that he may know when it is in danger of falling below the standard.

(4) The account kept of the rations fed allows of a comparison between them and their cost in different herds and so enables farmers to judge for themselves as to the cheapest feeding for milk production in the case of their own stock.

ENTERPRISE IN DAIRY FARMING.

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IT is often said that the farmer would take more interest in the progress of agricultural science if he could be shown farms run on the latest lines and yielding a greater profit per acre than he obtains from conventional practice. Examples of farmers who have benefited by the application of scientific teaching are now fairly common, but it is perhaps unusual to find a small working farmer who has had the enterprise to seek and adopt advanced practice to the extent indicated in the case described below. This article gives an account of the development of a poor farm into one that now supports 50 per cent. more stock than the average of the district, and the results of some preliminary experiments in an intensive system of cropping, along the lines of which it may be possible so to develop the farm that it will have a still higher stock-carrying capacity.

Situation, etc., of the Farm.—The farm is situated seven miles north of Derby at an elevation of 550 ft., with a western and somewhat wind-swept aspect. The fields are separated by stone walls, and by thorn fences. The soil varies from gritty loam to yellowish brown clay, in accordance with the underlying strata of middle grit and shales which outcrop across the farm. Farms in the locality rent at about 30*s*. per acre; Bargate, the farm in question, however, had been let at 20*s*. to the previous tenant, and when re-let by tender in March, 1908, was secured by the present occupier at a rent of 35*s*. per acre. Its total area is 48 acres, of which two are taken up by the house, steading, garden and orchard. At the change of tenancy, 5 acres of meadow land were sold for building purposes, and the new tenant rented an 8-acre meadow situated about a mile from the steading.

Cropping and Stocking of the Farm.—The cropping and stocking of the farm by the present and preceding occupiers are shown in Table I. (p. 438), together with figures, calculated from official returns, representing the average utilisation of 48 acres of land under crops and grass in the Belper Petty Sessional Division.

The farm now supports a much greater head of cattle than the average for the same acreage in the district, which includes a certain proportion of good river grass-land. Practically every farm in mid-Derbyshire is devoted to the production of milk for sale, though the smallest occupiers use what may not be retailed locally for butter-making and calf rearing. The milk produced on this farm is despatched every morning to Sheffield.

Comparison based on the numbers of stock kept, however, is insufficient, as it leaves out of account the milk yields of the animals kept. The ten cows and heifers on the average 48 acres

TABLE I.—*Comparative Statement of Crops and Stock.*

	Bargate, June, 1916—48 acres.	*Bargate, 1907—45 acres.*	*Average Utilisation of Land in Belper P.S.D., per 48 acres.*
Permanent pasture	21 acres ...	19 acres ...	27·6 acres
" meadow	8 " ...	18 " ...	14·0 "
House, garden, etc.	2 " ...	2 " ...	—
Total arable	17 " ...	6 " ...	6·4 "
"Roots"	*4·5 " ...	2 " ...	1·5 "
Corn	*6·5 " ...	4 " ...	3·3 "
"Seeds"	*6 " ...	— ...	1·6 "
Horses	2 ...	2 ...	3
Cows and heifers	15 ...	4 ...	10
Other cattle	12 ...	7 ...	8
Sheep	— ...	— ...	9

* 1915 figures.

produce about 6,000 gal. of milk per annum, assuming each to yield as much as 600 gal. Allowing an extra cow in place of the sheep, we may estimate the milk produced on farms in this district at 6,600 gal. per 48 acres per annum. As regards Bargate accurate records are available: the milk yield of every cow has been recorded at each milking since 1st January, 1912, and Table II. has been compiled from the owner's registers.

TABLE II.—*Milk Records of the Bargate Herd.*

Year.	No. of Cows and Heifers.	Total Yield of Milk per Annum.	Milk Yielded in the Half Year.		Average Yield per Cow per Annum.
			May to October.	November to April.	
		Gals.	Gals.	Gals.	Gals.
1912	15*	11,648	5,354	6,294	776
1913	15	11,974	6,329	5,645	798
1914	15	12,123	6,159	5,964	808
1915	13	10,639	5,011	5,628	818

* In this year there were 7 replacements, which accounts for the high initial average yield. The replaced cow and her successor are considered as one.

The annual milk output of the farm is seen to be nearly double that produced under average practice, and works out at 242 gal. per acre over the whole farm. This high yield is due in some measure to the elimination of cows with low records and to breeding for milk. It is significant that during the first recording year five cows were deemed unprofitable, in a small herd mostly milked by the owner himself. The herd now includes five cows that have yielded 1,000 gal. in one lactation period.

FIG. 1.—Winter Corn and Vetches after Mangolds. Photographed 8th July, 1916. Cut for Hay and Silage, 20th July.

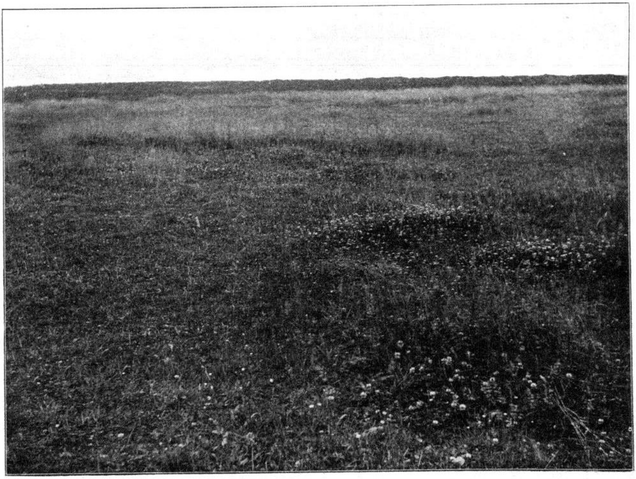

FIG 2.—The Hill-side Pasture on Light Soil, 8th July, 1916. Treatment: Basic Slag, 1910 and 1914; Farmyard Manure, 1915.

About four heifer calves are reared each year, and these enter the herd at 2½ years, to replace the draft cows which are fattened off and sold usually during the winter. The bull used during the years 1914 and 1915 was home-bred, out of a cow which yielded 1,144 gal., and by a pedigree sire. The present head of the herd is a Lincoln Red Shorthorn of dairy ancestry, and approved for the Board's live stock scheme. Two registered cows of that breed have recently been added to the herd.

The original condition of the farm is shown by the number of cattle kept in the year 1907 by the then tenant, who informed the incomer that the farm would not carry more than five cows. That the present state of the holding is due to systematic development is indicated by the growth of the business turnover shown in Table III., which has been compiled from the farmer's account books. "Gross Returns" comprises the total amounts received for milk, fat stock, etc., sold, together with any increment in the valuation of the live and dead stock. The standard prices per head adopted for the cattle in 1908 have been used at each succeeding valuation.

TABLE III.—*Extracts from the Bargate Accounts.*

Year.	Gross Returns.	Feeding-stuffs Purchased.	Fertilisers Purchased.
	£ s. d.	£ s. d.	£ s. d.
1908	403 19 1	57 19 1	45 2 7
1909	446 12 0	105 11 4	24 0 3
1910	598 18 9	85 13 0	24 9 6
1911	699 12 8	144 2 10	42 7 2
1912	*852 2 9	199 3 1	40 5 6

* Part of this amount is for an increased number of draft cows, sold on account of their low records.

Developing the Productive Capacity of the Farm.—In developing the productive capacity of the farm, attention has necessarily been paid to both the winter and the summer requirements of cattle; and it may be seen from Table II. that the quantities of milk produced in the two periods are approximately equal. In the accepted sense of the term the farm is practically self-supporting; for all the bulky foods used are grown on the holding, wet brewers' grains are not fed, and cake-feeding is not resorted to until late summer. In certain years, however, it has been necessary to take a few acres of eddish, as some of the pasture land is liable to "burn." The expenditure on concentrated foods is liberal, but not unusually heavy when considered in relation to the number of cows milked and fattened, the milk yield, and the number

of other stock, which includes several fattening pigs and a flock of poultry. In recent years preference has been given to concentrates that correct the deficiency in protein of the home-grown roots and fodder, and such foods as the cakes and meals made from soya beans, ground nuts and decorticated cottonseed have, therefore, been largely substituted for Indian meal and bran. It is unfortunate that milk records were not kept earlier than 1912 to bear out the farmer's testimony to the practical value of a knowledge of the principles of feeding. Concentrated foods are fed strictly in accordance with individual milk yields—a practice rendered possible by daily recording. Under the continuous cropping system, whereby foods richer than roots and meadow hay in protein are grown on the farm, it is hoped to reduce the expenditure on concentrated foods; indeed, this was one of the features of the system that most commended itself to the farmer.

The winter-stock-carrying power of the farm has been developed by increasing the area under arable cultivation, growing full crops—home-compounded artificials have been regularly used on "seeds" and corn as well as "green crop"—and treating the meadow land liberally. Manure made indoors is usually returned to those parts of a farm that produce winter food; the increasing head of stock wintered, with concomitant increase in "corn" fed, has been, therefore, an important means of increasing the fertility of the arable and meadow land. A factor requiring special mention in this connection, however, is the conservation and use of the liquid manure: the tank has been regularly emptied, and a proper cart is now used for the distribution of the liquid.

The extent of the improvement in the pasture is, in the opinion of those who know the history of the farm, literally wonderful. One field and part of another have been under-drained with beneficial results, but the chief factors in the transformation of the pastures have been basic slag and close grazing. The whole of the pasture land has been slagged three times since Lady Day, 1908, excepting one field of 5 acres, which has had two dressings of slag, and one of yard manure. This field, which lies on the face of the hill and has a light soil, responded to both applications of slag, developing a fine, clovery herbage, and "eating off" close and even. Yard manure was tried on a portion of it in 1912 and produced a more robust growth of both grasses and clover, this leading to the whole field being subsequently dressed. On part of another field where the soil is sandy, the rest being heavy, superphosphate and ground lime

FIG. 3.—Left: Second Growth of Rye, which had been Green Soiled in Spring. Right top corner: Winter Oats and Vetches for Hay and Silage. Right: Cabbages planted after Tares fed green during June. Photographed 8th July, 1916.

FIG 4.—Second-year Hay Crop, Elliott Mixture, on the field that before breaking up was inferior old pasture which had proved unresponsive to manures. Photographed 8th July, 1916.

were substituted for the third dressing of basic slag, in accordance with the results of county experiments with pastures on various soils. The field that required draining was formerly an unpalatable mixture of "iron grass" (sedge), and benty grasses, with little bottom herbage—it had not been down very long. It is now, like the rest of the pasture land, a carpet of white clover and fine grasses. A bed of creeping thistle in another field had given continual trouble up to last year, when an organised attack was made on it. The thistles were spudded in spring, mown before and again after harvest, and again spudded in autumn. This year very few have appeared, and spudding once will probably eradicate them.

At the entry in 1908, three pasture fields were particularly inferior: what little herbage did grow was unpalatable, and the turf was matted to the depth of about two inches with undecayed roots and fibre. These were the really old pastures, having been in grass for longer than the memory of the oldest inhabitants of the district. They had the reputation of always having been poor and incapable of improvement. Two of these fields were broken up in the first two years of the tenancy to increase the area of arable land; they are now useful ploughed fields. The soil is yellowish clay. Difficulties were encountered in their conversion; one early showed a liability to finger-and-toe, probably due to infection from the older-ploughed land and to want of lime; and the other revealed on ploughing severe infestation with wireworm, which, in spite of a dressing of a well-known specific, devastated the first crop (oats) and seriously damaged the second crop (potatoes).

The third field, which adjoins the steading, was not broken up, owing to its convenient situation for a home paddock. An attempt was therefore made to improve it by manuring. In the autumn of 1908 a dressing of 7 cwt. per acre of 42 per cent. basic slag was applied, and the following winter 2 acres received a further treatment with 6 tons per acre of night soil. In the summer of 1911, admittedly an unfavourable season, this field of 6 acres failed to support a stocking of four calves and two horses in their off-time. The manures had produced no visible improvement. The tenant now resolved to break it up and lay it down afresh. From a portion of this field, which was cut off at the change of tenancy and has remained in the original condition, it may be seen that the chief obstacle to manurial improvement was the matted state of the turf. Clovers and desirable grasses cannot spread unless there is moist soil at the surface into which they can strike root. In a matted turf, what-

ever clover plants have survived are incapable, even under the best stimulation, of rapidly winning space from the inferior herbage that has gained possession of it by natural selection. There are ways of clearing the bottom, but all except that of breaking up are slow and prolong the period of low productivity. In these days of scientific seeding and manuring, it does not require a generation to establish a profitable pasture.

The farmer received much warning against breaking up this "old pasture," and the landlord did not escape advice to intervene. To the latter's credit, it should be here recorded that he had given the new tenant complete freedom to exercise his discretion in such matters. The landlord also sanctioned the removal of superfluous fences (six fields now occupy the same area as the former thirteen), provided tiles for any necessary draining, and extended the buildings to accommodate the increasing head of stock. The farmer attaches due credit to the part played by his landlord.

The method adopted in the breaking up of the third field may be of interest, as it was the outcome of experience with the two broken up previously. In November, 1911, the field was ploughed in narrow furrows, little deeper than the turf. At this stage it was drained, with 3-in. tiles placed 3 ft. deep and 15 ft. apart, and, in the following February a dressing of 3 tons per acre of fresh lump lime was spread. In March, the furrows were cross-ploughed about the same depth as at the first ploughing, cutting the turf into 6-in. squares, the plough being fitted with a specially large disc coulter. The turves were then teased out with the tine implements, and afterwards buried under a deep furrow. Oats were sown, and yielded about an average crop, there being no trouble from wireworm. In 1913 "green crops" were put in, and yielded according to the writer's estimates: swedes, 25 tons, mangolds, 40 tons, and cabbage, 40 tons per acre, the crops having received both dung and artificials, and the plants standing thick on the ground. In 1914, oats (with artificials) and grass seeds were sown. The oat-seeding was purposely rather light, and the grass-seed mixture was one of the Elliot type. The maiden seeds were slagged and dressed with liquid manure during the winter, and yielded in the two cuttings of 1915 fifty cart-loads of hay on the 6 acres—more than 3 tons per acre. The 1916 crop was about 2½ tons per acre, and the field will now be treated as pasture. Having regard to the mixture of seeds used, and the farmer's understanding of the virtues of basic slag, there need be no doubt that this field will soon be a good permanent pasture. The wisdom of breaking up in this case is now freely admitted, and

the crops grown during the arable period bore testimony to the store of fertility that was locked up in the surface of the old pasture. The soil of this field is a brownish yellow clay.

The 8-acre meadow, which lies about a mile from the steading, is annually dressed with yard manure, and has had since 1907 three applications of basic slag, to which it responds. The soil here also varies from heavy to light. The eddish is grazed by young cattle which are out-wintered on it, receiving an allowance of roots and chop, until the end of February, when they are brought indoors.

Enterprise similar to that practised in the main departments of the farm has entered into the management of the orchard, garden, poultry and pigs. For instance, fish meal has been tried and adopted as a valuable ingredient in the diet of growing pigs.

In the matter of mechanical equipment a 48-acre farm does not offer great scope. This year's additions include a hay unloader, a hay collector and a hay bogie, the farmer intending to make his hay on the tramp-coil system. Consideration is now being given to appliances specially useful in connection with the new system of cropping: the one-way plough would be handy in preparing successive strips of land for cabbages after tares cut for green soiling; while the disc-harrow is well-nigh indispensable to the system. It should, perhaps, have been mentioned in connection with the recording of milk yields that the work is simplified by the use of pails of standard weight, whereby pouring into a weighing-bucket is obviated. The whole of the regular work on the farm is done by the farmer himself with the assistance of a youth. A certain amount of neighbourly co-operation is practised in such operations as harvesting and threshing.

The net result of the first year's residence at Bargate was an apparent loss of about £50. A profit was shown on the second year's working, but it was not until the third season that the farm began really to pay. In the development of the farm the profits remained invested in the form of additional stock and working capital generally; there was no haste to convert the profits into cash for investment in other securities. The keeping of proper acounts has enabled the farmer to review his progress at the end of each year's working, and has assisted him in deciding what expenditure might yield a profitable return. That the farm has responded to its liberal treatment is sufficiently indicated in Table III.

The further development of the farm involves considerations such as another enlargement of the buildings and the employment of additional horse and manual labour. A larger head of stock can be carried by breaking up pasture land to grow soiling

crops for summer feeding, and "winter greens" and silage for winter use. If pasture land is broken up for this purpose, however, it must be done on a scale sufficient to provide full work for another pair of hands; and the question to be decided is whether the system would enable sufficient additional stock to be kept to pay for the extra expense—and risk—involved.

Whether drastic changes will be made in the system of farming will depend on the results of experiments now being made by the farmer. The system in view is that described as Continuous Cropping.* The present trials are confined to the arable portion of the farm. The decision to experiment on the lines of continuous cropping arose from a query addressed to the writer by the farmer, who saw that land ordinarily lies bare for seven or eight months between corn harvest and the planting of a succeeding cabbage crop. The writer introduced him to the literature on the system, and has from time to time discussed it with him; apart from that, however, the experiments have been conducted by the farmer himself.

Rye for Green Soiling, followed by Marrow-stemmed Kale.—One acre of oat stubble was dressed with 10 tons of yard manure, ploughed, and broadcasted in the third week of September, 1915, with 16 stones of Giant Essex rye. In February an attempt was made to dress the crop with liquid manure, but owing to the soft, sodden nature of the ground, into which the cart-wheels sank deeply, this was discontinued after a few "bouts," and the remainder was treated with nitrate of soda at the rate of 1 cwt. per acre. The portion dressed with liquid manure made distinctly the better growth and was ready for cutting ten days earlier than that treated with nitrate of soda.

The crop was fed green from 25th April to 25th May, the quantity cut each day being as much as could be loaded on to a box-cart fitted with deep "grain" boards. On 20th May it stood 2 ft. 9 in. high, and was just beginning to shoot. A strip that had been cut first and again dressed with liquid manure had made a second growth of 12 in.: this was being reserved for seed corn. On 8th August, it was ripening, and looked likely to yield an average crop of corn; there was a fairly thick plant.

The green rye was fed to dairy cows, horses, bull, and pigs. All were fond of it, and did well on it. There was no laxative effect. The cows had commenced to go out to pasture a little during the day, but the introduction of the rye in their diet resulted in an increase in milk yield, which the farmer, calculating from his milk records, valued at £3 per week. At the time when

* See articles by T. Wibberley in this *Journal* for November and

the cutting of the rye began, the barns and root-pits at Bargate, as was general in Derbyshire last spring, were empty, and the pastures not ready for regular stocking. The effect of having this acre of rye was that the cows were kept off the pastures at night until 25th May, without additional expense in "corn." Reservation of the pastures in that manner has a special value on this farm, owing to their heavy stocking and their liability to "burn" if eaten bare early in the season.

The rye stubble was given 20 tons of dung, ploughed (it broke up beautifully), worked, and broadcasted on 27th May, with 4 lb. of marrow-stemmed kale. This brairded well and received 1 cwt. of nitrate of soda. It should provide useful food for the dairy cows in early winter and be off the land in time for an ordinary spring-sown crop. (Marrow-stemmed kale is sown in the Elmton district to provide autumn feed for sheep and allowed to stand for a second eating in early spring.)

The growth of rye for spring soiling will be a regular practice in the future at Bargate, and on neighbouring farms. It is difficult to estimate the direct and indirect benefits of this acre of rye: apart from the rye itself, there is the prospect of a second crop, perhaps as heavy as that which the land would have produced in the form of cabbages had it lain bare all the winter. Had it been elected to plant cabbage after rye, this could have been done at, or earlier than, the usual time for cabbage-planting in this locality.

Winter Oats and Vetches followed by "Winter Greens."—Three acres of oat stubble in the same field were given 10 tons per acre of yard manure, ploughed, and sown on 21st October, 1915, with 8 stones per acre each of winter oats and winter vetches. The land was rolled after sowing, this under the circumstances proving a mistake, as the result was a "winter cap" and slow growth of the crop during the winter. Part of this crop was used during June for feeding to the housed stock—calves, horses, and pigs—and the land was immediately manured, ploughed, and planted with home-grown cabbage plants of the early Giant Drumhead variety. The main portion of the crop was mown on July 20th. The bulk was made into sweet silage on the 21st and 22nd, and the remainder tramp coiled for hay on the afternoon of the last day. The yield reckoned as hay was approximately 2¾ tons per acre. On August 8th the stubble was being ploughed in preparation for 2¼ acres "rye and rape" for March and April feeding, and ¼ acre hardy green turnips for earlier use. Artificial manures will be applied before seeding.

This crop also will be sown again, but with the following modifications of the first trial: the seeding will be 10 stones of

winter oats, and 6 stones of winter vetches; if seeding cannot be effected in September a proportion of rye and wheat will be substituted for oats; the land will not be rolled after sowing; and to bring the crop in earlier it may be top-dressed in February.

Winter Corn and Vetches, Seeded for Autumn Soiling.—One acre of land that had been under mangolds was ploughed, and on 6th November broadcasted with the following mixture of seeds: winter vetches, 4 stones; rye, 4 stones; winter oats, 4 stones; and wheat, 2 stones. This crop grew well from the beginning. About the end of April a one-year mixture of grass and clover seeds was broadcasted and harrowed in: these have taken well.

The tare crop was cut on July 20th, and the greater part converted into sweet silage—stacked with the aid of the hay bogie and the horse fork. A few tramp coils were made. The grass was then dressed with liquid manure, with the object of securing a cut for green soiling in the autumn. It is also likely that the corn will produce a certain amount of second growth for cutting at that time.

The mixture of grain used here proved particularly suitable, and the yield reckoned as hay was about 4½ tons per acre. It would seem that 4 stones of vetches make an ample seeding: the vetch plants climb up the tall, straight corn, and fill up the "body" of the crop without crowding out the "seeds" in the bottom. If there were an early flowering vetch it would be useful, as then rye and vetches only might be sown. The wheat and winter oats were in the milky stage when the vetches began to pod, but the rye was somewhat further advanced. It is proposed in next year's trial to graze the crop back about the beginning of May.

The farmer was specially pleased with this crop. It was a dense growth, 5 ft. in height, with the rye heads extending upwards for another foot. Cutting did not present great difficulties.

It still remains to be seen what will be the yields of the second crops—marrow-stemmed kale, rye and rape, and grass, while the value of "winter greens," silage and tare hay for dairy cattle will be tested during the coming winter. Had weather permitted the conversion of all the tares into hay, ensilage would not have been included in this years' trials; but the test described by Mr. A. W. Oldershaw in the June issue of this *Journal* indicates that oat and vetch silage is quite a good food for milk production. Ensiled brewers' grains are very commonly used on dairy farms in Derbyshire.

The writer desires to record his thanks to Mr. C. C. Mort with whose work this article deals, for facilities and assistance in the collection and verification of the information here presented

THE CONSTRUCTION OF COW-HOUSES.*

THE first requirement in the production of milk for human consumption is cleanliness, and one of the most important factors in securing clean milk is a well-constructed cow-shed.

It is comparatively easy to provide new buildings which will meet all requirements, but it is more difficult to alter an existing building so that it can be made as suitable as a new one. This fact, however, should not deter owners and occupiers from making alterations on the lines suggested, as even the most unsatisfactory buildings can often be much improved without great expense.

In designing a cow-house, the principal details which should receive consideration are the following:—

Site, including aspect and arrangement with regard to other buildings;

General Construction of the Building, including the walls, roof, floor, drainage, and water supply;

Internal Design, including arrangement of stalls, stall divisions, feeding-troughs, manure and urine channels, and passages;

Air Space, and Floor Space;

Ventilation, including the various methods by which this is attained; and

Lighting.

The Site.—If possible, the site should be moderately high and dry ground. The building should be conveniently placed for the supply of fodder and roots and the preparation and storage of feeding-stuffs. In order to facilitate the removal of the manure and urine, the site should, where practicable, be on ground with a gentle slope.

There should be easy and ample access to the nearest pasture without interference with other stock, and without affording the cattle an opportunity to stray. To ensure ample sunlight a south, south-east, or south-west aspect is desirable, and, while the cow-house should be sheltered from strong winds as far as possible, it should not have any buildings, such as hay or straw-sheds, or buildings occupied by other kinds of stock, erected against the side walls. In designing new farm buildings these points can be taken into consideration, but when existing buildings are being altered, difficulties may occur. With care and skill, however, the average building of the present day may be considerably improved.

* This article is a reprint of revised Leaflet No. 241, copies of which may be obtained gratis and post free on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

General Construction.—*Walls.*—The walls may be of any suitable material which is plentiful and cheap in the district, and, with the necessary precautions, good buildings may be erected of stone, brick, concrete, wood, or wood and iron. If of stone or brick, all the walls should be neatly pointed, and, where economic considerations permit, it adds to the cleanly appearance and sanitary efficiency of the building if the inside face of the walls is built with salt-glazed bricks or cement finished with a smooth surface to a height of not less than 5 ft. from the floor. Above that height the surface of the walls should be of such a nature that they can be easily cleaned and disinfected or lime-washed. If the building is of wood, or wood and iron, all uprights, sills, and outer boarding should be of timber which has been creosoted under pressure. The extra expense of creosoting will not be great, while the life of the building will be considerably increased. To obtain sufficient cubic air space within the building the height of the walls should not as a rule be less than 8 ft. 6 in. from the threshold to the top of wall-plate.

Roof.—In recent years many kinds of roofing materials have been placed upon the market, and used with varying success. but for efficiency and endurance there is nothing to surpass slates or tiles. The building should be open to the ridge. In constructing the roof-timbers, where the span does not exceed 30 ft., there is no cheaper or stronger form of support than the king-post principal for double cow-houses. For narrow spans for single cow-houses there are several kinds of roof trusses of simple design which can be adopted.

Doors.—The doors for the entrance and exit of the cows should be not less than 4 ft. wide in the clear, and should be hung in halves. Simplicity of construction should be aimed at, and it will be found that plain, strong-ledged and braced doors are the most satisfactory and durable. The sharp angles of all door-frames should be rounded off; and, where doors are hung in brickwork, round-nosed bricks should be used to lessen the risk of injuries to the cows.

Floor.—The first point which should be considered in connection with the floor is its level compared with the existing roadway, or completed surface round the building. In many cases, particularly on level land, or where there is difficulty in getting sufficient fall for the drains, the floors are laid at too low a level, with the result that the floor and stalls are often damp, and the roadway outside is covered with mud and slush. In not a few instances the roadway outside is difficult to improve, as it cannot be raised, owing to the risk of running the surface

water into the building, instead of away from it. Such conditions should be guarded against by laying the floor at a comparatively high level. If also the site does not slope, so as to provide the requisite fall for purposes of drainage, the floor should be raised sufficiently to secure this.

The main flooring materials should be either cement concrete, or blue bricks. Where clean, sharp sand and gravel are available, good cement concrete, not less than 4 in. in thickness, properly laid and finished, is probably the best material for general purposes. The finishing coat should be laid on as soon as the foundation concrete is sufficiently hard for walking upon, and before it is dry. This finishing coat should consist of two parts of finely-crushed granite, and one part of cement, and should be at least 1 in. in thickness. The surface should be grooved or slightly roughened to prevent the animals from slipping. Care must be taken that the ground is quite even throughout, well rammed, and uniformly firm before laying the concrete. Properly finished concrete is scarcely ever slippery if clean, but may be more or less so if dirty. It is as cheap as any other flooring material laid equally substantially, is less absorbent than most, and probably more durable than any other. Where blue bricks are used for the passages and stalls, the bottom of the manure channel might be formed in cement so that there are no junctions to hold urine; the uniform gradient necessary for this part is also more easily maintained with cement than with bricks.

Whether the floor is made of cement concrete, or blue bricks, it will be advantageous to use rammed clay or chalk-rubble for a space of 3 ft. from the manger, as this will enable the cows to kneel with greater comfort and will prevent enlarged knees.

Drainage.—There should be no covered drains inside the cow-house. The urine from the gutter should be carried off by means of a 6-in. glazed pipe, which should run through the wall and discharge 6 in. beyond over a trapped gully, or to the manure in the case of a covered yard; a grid should be fixed at the end of the discharge pipe to prevent solids entering the drains. The drains outside the cow-house should be as short as possible, and should have a good fall, otherwise they will be difficult to keep clear. Where the drain is of considerable length, or bends to any extent, inspection chambers with loose covers should be introduced.

A good plan is to have a water-tight tank close to the dungstead into which all leakage from the latter should run, and into which the drain from the cow-house should discharge. A urine tank in such a position permits of the contents being distributed

over the top of the manure heap, though it is best to apply it direct to the land, *especially to meadows*.* For raising the contents of the tank a chain or plunger pump should be fitted.

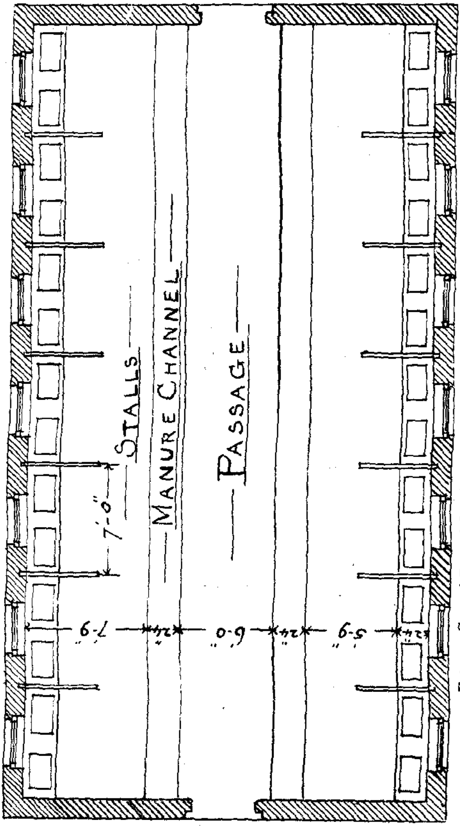

FIG. 1.—Ground Plan of Cow-house: Two Rows of Stalls, without Feeding-passage.

* See Leaflet No. 93 (*Farmyard Manure*).

Water Supply.—The best water supply is that obtained from springs and streams, or other suitable sources of pure water at a higher level than the buildings, so that water can be brought to them by gravitation, which is the cheapest method. If such sources are not available, the rain-water should be collected in storage tanks fixed at a sufficient height to supply the cooling-room and cow-house; alternatively, well-water may be pumped up into tanks.

It is desirable to arrange for an ample supply of water to the cow-house for watering the stock, for cleansing, and for a washing-basin where the men can wash their hands before milking. Any tank for the storage of water used for the washing of the milkers' hands or the cows' teats should be properly covered and ventilated.

Internal Designs.—*General Arrangements.*—In many parts of the country the most common type of cow-house is that represented in Fig. 1, in which the cows are stalled with their heads facing one of the outside walls. In this type the one passage is used for conveying food to the cows, removing the manure, and taking away the milk. This arrangement is applicable to either single or double cow-houses.

The interior dimensions of this building (Fig. 1) give a total distance from side to side of 25 ft. 6 in., and its narrower span would enable a simpler roof-truss to be used than the alternative plan shown in Fig. 3.

The method of stalling the animals shown in Fig. 2 is one of the most approved, particularly where existing farm buildings are being adapted; where, however, a new building is to be erected for a large number of cows, it will be more economical to adopt design No. 1. In Fig. 2 the same principle is followed as in Fig. 3, except that one row of cows is provided for instead of two.

Where there are less than 12 cows, and they are ranged in a single row, a feeding-passage is not necessary. One is often provided because it is a convenient way of obtaining the prescribed amount of cubic space in the cow-house; but this end is often defeated in practice by the custom of using the feeding-passage for the storage of fodder. This is an objectionable system, and it would be far preferable to dispense with the feeding-passage and store the fodder in a mixing-house at one end of the cow-house; half the space in the mixing-house could be included in reckoning the cubic space per cow, if it is only partially partitioned off from the cow-house.

The arrangement shown in Fig. 3 has a great deal to recommend it, and though the initial cost is fairly high, the advantages obtained may warrant the extra expense.

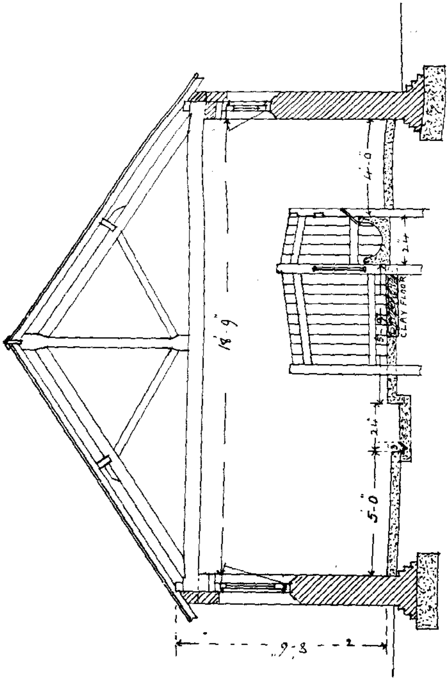

FIG. 2.—Cow-house with One Row of Stalls and Feeding-passage.

In one type of cow-house which is very common in many districts, and is frequently met with in most modern dairies in America and on the Continent, all the stock are fed from a central passage, while the manure and the milk are removed by the two passages at the side. In a building of this class the cows' heads are a long way from the fresh-air inlets, and the animals breathe into each others faces from opposite sides of the passage, so that exceptionally good ventilation is needed to maintain the general health of the cows. Moreover, such an

arrangement is to be strongly deprecated as being likely to assist the spread of disease from animal to animal by inhalation.

Passages.—A feeding-passage less than 3 ft. 6 in. wide cannot be worked in with comfort, and a standard width of 4 ft. is preferable. The passage should have direct access to the mixing-house or store.

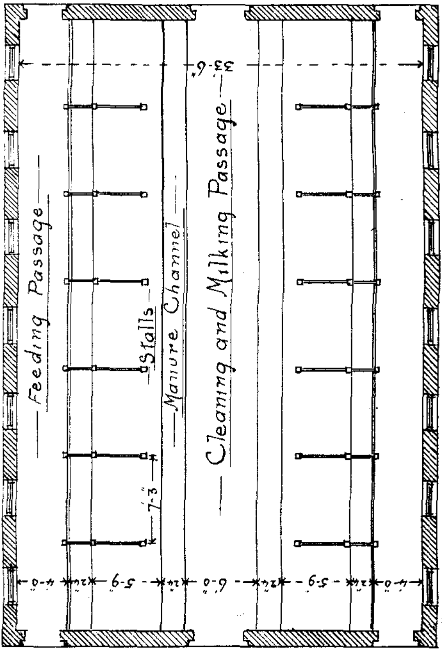

FIG. 3.—Ground Plan of Cow-house Two Rows of Stalls and Feeding-passages.

Milking-passages should be from 4 to 5 ft. wide for single cow-houses, and 5 ft. 6 in. to 6 ft. 6 in. for double ones. With a narrow passage there is always a risk of the cans and their contents being splashed and contaminated with urine or dung.

Stalls.—The floor of the stalls should be given a fall of about 2 in. from the trough to the manure channel; this will facilitate the drying of the floor after flushing with water.

In determining the length of the stalls regard should be had to the breed to be kept.

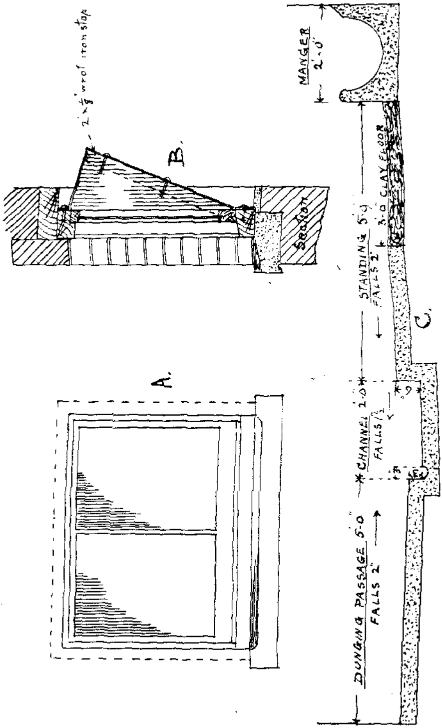

FIG. 4.—A and B—Details of Hopper Window. C—Section of Cow-house Floor: One Row of Stalls without Feeding-passage.

For small cows, such as Jerseys, Kerrys, and young Ayrshires, the stall (measured from the manure channel to the wall or division between the cows and the passage) should be about 7 ft. long, inclusive of the breadth of the trough. For Ayrshires, a stall of 7 ft. 3 in. is quite sufficient, while Shorthorns require one of from 7 ft. 6 in. to 8 ft.

If the stalls are too short, the cows will stand in the manure channel, and sooner or later their hind feet will become soft and diseased. If the stalls are too long the cows drop their dung on to the floor, and when they lie down are almost sure to soil their hindquarters or udders. Under such conditions the labour necessary to keep the stalls and cows reasonably clean is much increased.

For the smaller cows, each double stall should be from 6 ft. 3 in. to 6 ft. 9 in. wide, and for the larger ones, from 7 ft. to 7 ft. 6 in. If the stalls are too narrow the cows tread on each other's legs, udder, and teats, and injury to the two latter almost invariably means loss of a quarter. If the stalls are too wide, the cows turn round in them, and drop urine or excrement in the trough, or on the floor of the stall.

Stall Divisions.—It is usual to stall the animals in pairs. The principal advantage of introducing divisions is that they render the cows less liable to disturbance, and prevent them from turning round and fouling their beds.

The stall divisions may be made of cement concrete, stone, wood, or iron. Wood is most generally used. The divisions should be of simple style to facilitate repairs. An illustration of a stall division is given in Fig. 2. A post 4 ft. 6 in. high, called the headpost, is placed close against the front of the manger, and another 4 ft. high, called the heelpost, 4 ft. 6 in. to the rear of it. Into these are mortised top and bottom rails for receiving the boarding, which is nailed upon one side only. A slighter post is placed at the back of the manger, in the feeding-passage, to receive two short rails taking that section of the boarding which continues over the manger; the division extends to the bottom of the manger if the feeding-trough is continuous. Occasionally the divisions are made with four rails instead of boards; this arrangement answers well and promotes the free circulation of air. The headpost by the feeding-trough serves for tying up a cow on each side. Two ¾-in. iron rods, 2 ft. long, are bolted through the post, and to these rods iron rings are attached for sliding up and down. The neck chains of the cows are affixed to the rings.

During recent years hygienic considerations have led to the use of galvanised steel tubular divisions and stanchions in the equipment of the cow-house. It is claimed that the cows are kept clean, healthy, and comfortable under the most sanitary conditions. The stanchions are hung on chains, allowing freedom for cows to lie down comfortably. They ensure cleanli-

ness by keeping the cows in place—"forward" when lying down—"back" when standing. The cows have no weight to carry, and have perfect freedom for the neck. These sanitary cow-house fittings are sold by several manufacturers.

Troughs.—A feeding-trough formed in cement concrete, and running the length of all the standings, is cheaper than any good form of separate trough; it can be more easily cleaned out, and, if supplied with a water-tap at one end and a waste outlet at the other, it makes an effective water-trough as well. The chief objection to the continuous trough is that tuberculosis may be conveyed from an affected to a healthy animal by the saliva of the former being carried down the trough.

In many districts separate troughs for each animal are preferred. Frequently these consist of half-pipes set in concrete, with cement coping, or are constructed of brown glazed earthenware blocks. Where separate troughs are used water may be supplied in small circular troughs 9 in. or so in diameter, set in a recess cut out of the stall division, close to the wall or feeding-passage division, and about 1 ft. above the trough. These water-troughs should have a balanced lid which is hinged at the back and projects over the edge ½ in. or thereabouts, and is so arranged that it cannot be lifted quite up to a perpendicular position. All stock seem to learn to lift the lid with their nose in a few days, and as soon as they have satisfied their thirst, the lid falls and keeps out dust, straw, etc. The level of the water in the troughs may be automatically regulated by a ball cock.

Manure Channel.—Probably no part of the average cow-house is constructed in so faulty a manner as the manure channel. In no case should it be less than 16 in. wide, and in erecting new cow-houses a width of not less than 24 in. should be allowed. It need not be of greater depth than 6 in. at the cow's heels, and at the side next the passage 4 in. will be quite enough. The channel should have a fall of 1½ in. towards the gangway, and a semi-circular channel for the liquid formed at the back about 3 in. wide, as shown in C, Fig. 4. It is undesirable to give more than 2 to 3 in. of fall from the feeding-trough to the channel. A fall of ½ in. per yard run in the length of the channel is sufficient. If the channel is any narrower than suggested it may quickly become blocked with manure, and the urine may collect between each heap of manure, the result being that when a cow lies down her tail may drop into the pool of urine; under such conditions milk is almost certain to be contaminated.

Air and Floor Space.—*Floor Space.*—The provision of sufficient floor space is of sufficient importance. When the floor space per cow is insufficient the operations of feeding and milking and the removal of the manure are hampered, while it is more difficult to ensure clean milk. Although the actual area required by a cow for her comfort is regulated by her size, it is unnecessary to consider the size of the individual cow in determining the total area required. With passages of the width suggested for the different designs of cow-houses, a floor space of not less than 45 sq. ft. will be provided per cow.

Cubic Space.—Opinions as to the suitability or unsuitability of a cow-house from a sanitary point of view are frequently based on the amount of cubic space provided. This is due to the idea that in a building with a large cubic space the air remains approximately pure much longer than where the cubic space is smaller. Where buildings are occupied for a comparatively limited time, the inference is reasonably sound, but when applied to the case of a cow-house in which the animals are constantly stalled for half the year it is open to criticism. In the one case the building is frequently flushed with fresh air, whilst in the other this is only possible on rare occasions. Still, even in relatively large cow-houses, the air reaches a high degree of impurity shortly after the building becomes occupied, unless provision is made for ample ventilation.

This was strikingly brought out in the experiments carried out by the Highland and Agricultural Society during the winter of 1908 and 1909.* These experiments showed that there is no substantial gain in purity of the air, in buildings of very large cubic capacity per cow compared with those of more moderate size, and that if any cow-house, no matter what its cubic space per cow, is kept at a temperature of 60° F. or more, its air will contain about three times as much carbon-dioxide as if the building were freely ventilated and kept at under 50°F. While the production of milk may be as great in the one case as in the other, the health of the animals in a freely-ventilated small building will be better than that of those in a larger but poorly-ventilated building.

The cow-house must comply with the requirements as to floor area or cubic space laid down by any regulations adopted by the local authority under the Dairies, Cowsheds and Milk Shops Order. The usual minimum space prescribed is 800 cubic ft. per cow in cases where the cows are constantly kept and fed in the building, and 600 cubic ft. where they are habitually turned

* See *Journal of the Board of Agriculture*, October, 1909, pp. 550-552.

out for at least part of the day. In reckoning the cubic space it is usual to leave out of consideration anything above 12 ft. in height from the floor. This is, perhaps, not unreasonable with the ordinary type of roof, in which there may be a zone of more or less stagnant air.

Ventilation.—Closely associated with cubic space, but in reality quite distinct, is the question of ventilation. While a certain floor and cubic space must be provided before the cows can be conveniently and economically attended to, the health of the animals and purity of the milk will depend to a great extent on the means provided for ventilating the buildings. Special systems of ventilation are by no means essential. Openings in the walls to serve as inlets for the air, and similar openings in the roof to serve as outlets, will be quite effective, provided they are sufficient in number and size. Apart from windows the area of inlets should not be less than 40 sq. in. per cow: the area should be larger if the situation is at all sheltered. It does not follow that all available ventilation should be always made use of, but sufficient openings should exist to keep the air fresh, when the stock are in, and the air is calm. These openings should be provided with some arrangement by which the inlet of air can be easily regulated to suit the conditions of the weather.

The arrangements for the effective ventilation of cow-houses may be of the most simple kind. Air may be admitted by ventilating gratings, or drain pipes built in the wall about $5\frac{1}{2}$ or 6 ft. from the floor. Windows constructed of the hopper, louvre, or hit-and-miss slide types will also be of great assistance in providing ventilation. Perhaps the most satisfactory window for a cow-house is the hopper type (see A and B in Fig. 4). With this type draughts are prevented, and if the cows face outward, they get the benefit of the fresh air, while the odour and steam from the manure passes behind them and rises to the ventilating ridge. The best position for air outlets is admittedly the apex of the roof; such outlets are simply and economically attained by raising any desired number of ridge tiles, superimposed and bedded upon the adjoining ones.

This will be ample for tile roofs, whether plain or pantiled, and in most cases will also suffice for slate coverings.

Small and frequent openings in the roof are preferable to large outlets, as the down draughts are less, and the fresh air is distributed more thoroughly where the outlets are smaller individually than the inlets, but greater in their collective area.

Light.—The lighting of cow-houses is a matter of no little importance. Good lighting is essential for clean milking. Moreover, sunlight is one of the most powerful germicides, and should, therefore, be admitted freely into all buildings occupied by stock.

The simplest and cheapest means of lighting is to use a number of glass pantiles or slates in the roof, but the light from this source should be supplemented by that obtained from the upper part of any windows in the walls.

In estimating the total lighting area required for a cow-house 3 sq. ft. should be allowed for each cow.

THE PREPARATION OF HOME-MADE RENNET.

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AND

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THE present price of rennet has led to the carrying out of certain experiments, an account of which will be given in the September issue of this *Journal.* Rennet, prepared by the method described, has been used in the preparation of cheeses with results which appear to be satisfactory.

Rennet is prepared from the fourth stomach, or vell, of the calf, and has usually been extracted from the vells after they have been dried. At the present time, however, it does not appear to be possible to obtain a supply of dried vells which contain enough rennet to make an extract of sufficient strength for cheese-making. The cheese-maker is, therefore, advised to make use of fresh vells, or of vells which he himself has recently dried.

It is usual to state that the stomachs must be taken from calves of not more than about ten days old, which have, therefore, been only milk-fed. If such vells are available in sufficient number, the stomach contents should be shaken out, not squeezed, the vells slit up and put whole into brine. If, on the other hand, it is necessary to keep the stomach for any length of time before use, the contents should be shaken out, one end should be tied and the vell filled with salt. The other end should then be tied and the skins should be hung up in a current of air in a cool, dark place, until required.

If it is impossible to obtain stomachs of calves of the age which has been stated, an extract may be obtained from the stomachs of calves up to two or three months' old, or perhaps even older. Whether the extract is, as a rule, of the same potency as that obtained from younger vells is not yet known; all that can be said is that such rennet has been prepared and was satisfactory. It is mentioned here as a possible way out, in case of difficulty being encountered in securing stomachs of calves of the right age. Whether this extract owes its coagulating properties to pepsin (the ferment of the adult stomach), or to rennet, appears to be immaterial, since it was shown in this country some years ago that quite good cheeses could be made by using pepsin instead of rennet, and, since the War started, this work has been confirmed in America. If vells of this character are used, they should be slit open, the contents removed, and the inner surface washed with water. They should then be placed in the brine.

Preparation of Brine for Steeping.—The following method of preparing the brine solution is recommended. To 1 gal. of water, which had been previously boiled and cooled, add 2 lb. of salt and 1 oz. of saltpetre. Boil this solution for half an hour, and allow it to cool before using. This is sufficient for ten vells. If the vells are fresh, they may be put straight into the brine; if, on the other hand, they have been salted, the two ends must be cut off and the salt shaken out before putting them into the brine. An enamel pail, with a lid, has proved very suitable for this purpose. The steep should then be kept in a cool, dark place, and should be well stirred twice daily for a week with a clean, Scotch hand, pressing the vells against the side of the pail.

At the end of a week boric acid should be added to the steep in the proportion of 2 oz. to each gallon of brine. If sliminess should develop before seven days, the boric acid may be added at an earlier date. After the addition of boric acid, rennet tests should be made every two or three days until the extract is of sufficient strength to be of practical use. Two points must be borne in mind: (1) that, at its best, home-made rennet is not likely to be of more than half the strength of the commercial article; and (2) that the vells appear to vary considerably in their rennet-producing properties. It is, therefore, advisable to add a considerable number of vells to a larger quantity of brine: for example, 10 vells to a gallon as recommended, as thus the better vells balance the weaker, rather than to add 2 or 3 vells to a quart of brine. When possible, it is well to have more than one batch of vells steeping at the same time.

As a rule it should be found that an extract of sufficient strength is obtained at the end of ten days or a fortnight after the first immersion of the vells in brine. If this is not so, they may be left for another fourteen days, making a month in all, when, if the extract proves still too weak for use, it should be discarded.

If the extract from the first steep proves to be sufficiently strong, say about half the strength of commercial rennet, then the vells may be immersed in a second quantity of brine, ten vells and 1 oz. of boric acid to half a gallon, when quite a usable, though somewhat weaker, extract may be obtained.

Rennet Test.—The simplest means of testing the strength of rennet is the rennet test used by cheese-makers: 1 dr., or $3\frac{1}{2}$ cc. of the extract is placed in a cup; 4 oz. of fresh milk at a temperature of 85°F. is measured. A few pieces of cut straw are placed in the cup to indicate the exact moment that coagulation takes place. The milk is poured on to the rennet in the cup at a given time and stirred with a thermometer for 20 seconds, and, occasionally till it has coagulated, thus keeping the straws rotating. When the coagulating point is reached the straws will suddenly stop, and give a backward movement. During this period, care must be taken to keep the temperature of the milk at as near 85°F. as possible. This can be done by placing the cup in a basin of water at a temperature of 86°F.

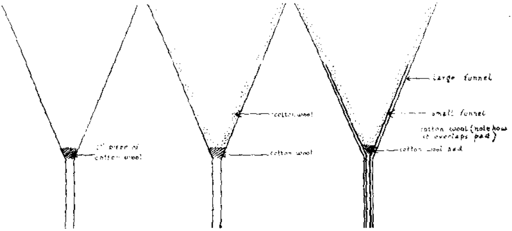
Fresh milk added to the ordinary commercial rennet will coagulate in about 33 seconds, but when added to home-made rennet at least double the time is usually taken.

Filtration of the Extract.—When the vells are ready to be removed from the brine, the whole should be poured on to two layers of cheese-cloth, fixed over an enamel pail. When most of the liquid has run through, the corners of the cloth are brought together and tied round with a piece of string. The bundle is then suspended over a clean, enamel pail, and allowed to drip into it for five or six hours. At the end of this time the bundle is well squeezed by hand, and if considered advisable the vells are placed in the second quantity of brine.

A cotton-wool filter is then prepared by taking a clean funnel, preferably not less than 6 in. in diameter at the top, and placing a piece of absorbent cotton-wool well over the hole in the bottom of the funnel. A long strip should then be placed round the inside of the funnel with the lower edges coming well down and over the edges of the piece first put in.

The whole must then be thoroughly well damped with water which has been previously boiled, and the cotton-wool pressed firmly against the side of the funnel, thus pressing out most of the water. The filter is then ready for use, and the extract should be poured on to the funnel. It may be necessary to pass it through two or three fresh filters before it becomes sufficiently clear. At first the liquid comes through rapidly, but gradually the filtration becomes very slow. It may, however, be hastened considerably by placing a small funnel inside the large one.

In this case the cotton-wool pad is placed inside the smaller funnel, and the strip reaches down from the larger funnel inside



Insertion of Cotton-wool in Funnels to make Filters.

the smaller, lapping over the pad at the bottom. There should be no wool between the two funnels. The filtered liquid may be collected in a scalded, enamel vessel, from which it may be transferred after the final filtration to well-scalded and stoppered stone jars or glass bottles through a clean funnel, or by means of a clean enamel or porcelain cup. Prepared in this way the final extract should keep good for at least six weeks if stored in a cool, dark place. It should have no smell other than the meaty odour natural to the vell, and it should not become markedly cloudy or show gas bubbles on its surface.

WOMEN IN THE ROOT FIELDS IN CARDIGANSHIRE.

DORIS W. STAPLEDON.

WHEN Lord Selborne's scheme for the employment of women on the land was initiated, the writer decided that the best method of employing women in her district (Aberystwyth) would be tc take gangs to any farmer who needed assistance.

Work only commenced in the latter part of April, and it was soon realised that extensive help would be required in the root fields, as the farmers in Central Wales have in the past been mainly dependent on casual labour for the singling of their roots. It was, therefore, decided to train a gang of women in hoeing, and this was accomplished, through the kind assistance of Mr. Abel E. Jones and the writer's husband, both of the Agricultural Department of the University College of Wales, Aberystwyth. A gang capable of doing good work was quickly formed; it consisted chiefly of girls from the Aberystwyth College, and the writer's own friends. As the former were very anxious to spend part of their vacation on the land, a camp was formed in a field adjoining the writer's house, and work was started on June 27th.

Turnip hoeing has been found to be eminently suitable work for women, and the farmers were quick to realise this—so much so, that the gang have had almost more work than they could keep pace with.

It may be of interest to give some particulars as to the methods adopted, as in the past so much of the singling in Cardiganshire has been "hand and knee" work that many farmers were sceptical as to the efficiency of the work that would be accomplished by a gang of women using hoes. In every case, however, where the women have been employed to assist a farmer with a field of roots they have been asked to finish the job. The maximum muster of the gang has been 12 (7 in the camp), all the members having worked together in a field under a foreman. In the beginning Mr. Stapledon rendered invaluable assistance by helping to supervise the work of the gang in a field, and later by taking an active part as foreman on many occasions when the writer was engaged on Red Cross duties.

Unfortunately, many of the fields on which the gang have been employed were already very much out of hand before operations were commenced. In order to make good work it was often necessary to side-hoe the rows before singling, and where the swedes were large it was found quicker to work in pairs, one "knocking out" the swedes into bunches with the hoe whilst the other did the final singling. Another advantage of this method was found to be that individual members had varied work, and could either hoe, hand-single or side-hoe. As all members of the gang did not work at a uniform pace it was also found advantageous to work at both ends of the rows so that it was not necessary for the faster workers to be continually passing the slower ones.

The anticipation that the greatest need for help would be in the root fields has been fully justified by the results, 16 farmers having already employed the gang for that purpose, while there have been only two demands for assistance with hay-making. From all points of view this was fortunate, as hay-making is a severe strain for women not used to constant manual labour, while it is not suitable for the employment of organised gangs on small farms. During the hot weather it was also a great advantage to be able to work at the gang's own hours, and it was found that the best work could be accomplished from 5.30 a.m. to 8.30 a.m., and again from 4 p.m., thus escaping the heat of the day.

During the first six weeks of the camp, in addition to the little hay-making and some gardening, the gang have hoed 970 rows of swedes averaging 160 yards each—or, say, about 88 miles. It should be pointed out, however, that the gang have very seldom worked at full strength, as 2 or 3 of the members were also partially engaged at the local Red Cross Hospital. The average working hours for the individual could not be said to be more than about 6½ hours per day, owing to the fact that much time was spent in getting to the farms, and also in managing the camp, which was run by the girls themselves with some assistance from the writer's maid.

The remuneration has been entirely on a piece work basis, and has been fixed at so much per row of 100 yards. Before the war the local price ranged from 1½*d.* to 2*d.* per 100 yards. The pay actually received has varied from 3*d.* to 4½*d.*, according to the condition of the swedes. The original idea was for the gang to bring their own food so as to be no bother to the farmers in the busy hay season. The farmers, however, have in most cases expressed a keen desire to supply tea, and in some cases dinner or even breakfast—an offer which has frequently been accepted.

As regards the financial side of the camp—the total earnings of the gang have up to date amounted to £17 5*s.*, of which the camp's share has practically balanced their living expenses. The hut and tents were kindly lent by the College, with the sanction of the Board of Agriculture and Fisheries, and the cost of erection was defrayed by an anonymous donor.

The writer desires to add that she received great assistance from her husband in getting into touch with the farmers who really needed help. Mr. Stapledon was able to bring the scheme to the notice of the farmers at a meeting of the Talybont Branch of the National Farmers' Union; this has resulted in the farmers, to some extent, pooling the amount of work it has been possible

Tea in camp.

Side hoeing.

Hoeing.

to get through, the aim having been to assist as many holders as possible rather than complete a 4 or 5 acre breadth of roots for but a few farmers.

There is no doubt that the gang idea has proved a great success; it has enabled women totally unaccustomed to farm work to be immediately useful, with practically no waste of time in training. It has appealed to the farmer, and the work has in a small way added to our food supplies, for, as the farmers for whom work has been done have remarked, it means much to get the roots singled in time, which on practically all the farms the gang have assisted could not otherwise have been the case. Although most of the work has been carried on comparatively near the camp, in a few instances where help was urgently needed the gang have gone by car—as far as ten miles to a farmer who was single-handed. The movement could not have been a success without the hearty co-operation of the farmers in the first instance. The writer is particularly indebted to Mr. Lloyd, Tan-Castell, who put his early swede field at the gang's disposal for the purpose of training; to Mr. Jones, Ruelissa; Mr. Hugh Jones, Pensarn; Mr. Lyke, Lodge Farm; and Mr. Ellis, Glanymor, all of whom guaranteed the gang work at the inception of the scheme before the members had proved their worth. The gang are also indebted to Miss Parry, Llydiadau (a member of the gang), who almost daily assisted with her car, and thus enabled the writer, with her own car, to carry the entire gang to work.

After remaining 10 days longer than was arranged for, the original members of the camp have now left; four of the writer's friends, however, have taken their place, so that a gang of 8 or 9 will be available until at least the end of the singling and hoeing season.

DRY ROT.

PERCY GROOM, M.A., D.SC.,

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IN practically every house in this country fungi are to be found growing on the woodwork or floor. Some of these are mere moulds, feeding feebly and slowly on the surface of the wood; others are obtaining their food from the soil or from dirt. Both of these classes are relatively or absolutely harmless so far as the destruction of wood is concerned. On the other hand, some of the remaining fungi met with cause deep-seated rotting and eventual destruction of the wood-fabric, and are known as "dry rot" fungi.

Popular Distinction between Dry Rot and Wet Rot.—Practical men distinguish between "dry rot" and "wet rot." Apparently they describe as "wet rot" such decay as is started in the standing tree or is already present in the unconverted log. As the fungi causing this form of rot chiefly attack the standing tree, they are known as parasites (even though in reality they often attack only the dead wood of such trees). By "dry rot" practical men mean the form of decay induced in timber that is apparently sound when first used as constructional material. Inasmuch as fungi commonly causing dry rot in houses in this country are largely not parasitic on trees, this popular distinction between "dry rot" and "wet rot" is partly justified.

Fungi Causing "Dry Rot."—The fungi causing "dry rot" in different structures (houses, mines, railway sleepers) in this country, and in different regions of the world, are by no means identical. For instance, *Merulius lacrymans*, the most malignant and widespread species occurring in the houses of north-temperate lands is said to be absent in the tropics, and this is borne out by experiments showing that moderately high temperatures, lower than those prevailing in the tropics, normally stop the growth of this fungus. There is no published list of fungi causing dry rot in this country, and only a few of the species chiefly responsible have been investigated. This is to be regretted for two reasons: first, the enormous annual loss due to dry rot in this country will increase because of the wider use of sapwood, the lack of proper seasoning, and inadequate ventilation; secondly, the most efficacious method of treatment of each variety of dry rot can be adopted only when detailed knowledge of the conditions of existence and distribution of the particular fungus concerned is available.

At this stage a brief account may be given of the domestic form of *Merulius lacrymans*, supplemented by comparative references to two other important types, *Coniophora cerebella* and *Polyporus vaporarius*.*

Infection of wood takes place partly by means of spores produced in large fructifications, which in the case of *Merulius* are usually pancake-shaped, flat, rust-coloured structures showing white margins. The rusty surface is marked by meandering ridges, the flanks of which are lined by hyphæ; many of these bear four spores each at their tips. Such flat fructifications occur on horizontal supports, but some of them, especially those facing upwards, are sterile. On vertical or oblique supports the fructifications assume the form of brackets,

the rusty, fertile surface facing downwards. This surface often shows the ridges uniting and thus producing irregular "pores" recalling those of a *Polyporus*. The margins of these "pores" may be drawn out into more or less large teeth, resembling small stalactites. The fructifications of *Polyporus vaporarius* (= *Poria vaporaria* of some authors), being white in colour, are easily distinguished from those of *Merulius*, though their "pores" may be shallow and uneven depressions or deep, fringed tubes. The fructifications of *Coniophora cerebella*, on the other hand, are often mistaken for those of *Merulius*, but the surface of the former is raised into isolated little bosses rather than into folds.

The spores of *Merulius lacrymans*, though thin-walled, are, when kept dry, long-lived, and retain their vitality for at least many months.

It is quite erroneous to suppose that the spores of *Merulius lacrymans* germinate only in alkaline solutions: on the contrary such germination takes place in water and in various neutral and acid solutions (including one per cent. citric acid). Until recently, however, investigators failed to cause these ubiquitous spores to germinate upon and infect wood, but it has now been proved that the spores germinate freely and infect wood previously attacked by certain other wood-destroying fungi, including *Coniophora cerebella*. This incidental co-operation between the two species goes further and has important practical bearings. *Coniophora* demands for its growth in wood a large supply of moisture; hence if wood be protected against excess of moisture it is guarded against this fungus directly, and *Merulius lacrymans* indirectly. *Merulius lacrymans*, on the other hand, once established, can manufacture water and thereby moisten and attack the driest wood, and incidentally render the latter open to attack from *Coniophora*. In passing, I may remark that in all the cases of dry rot examined by me I have never found an instance in which less than two kinds of fungi were engaged.

Merulius lacrymans, having once gained entrance to the wood, exhibits two different forms of active growth. On the one hand it sends into the wood numerous fine hyphæ, which feed upon the wood-substance and so destroy the whole fabric. On the other hand, the fungus gives forth numerous hyphæ which run over the surface of the wood, weaving themselves into cord-like strands, thin skin-like sheets, or producing thick, soft cushions. This superficial mode of development is important, for it characterises certain fungi causing the worst forms of dry rot, and enables them to spread rapidly. As the superficial

mycelium grows forwards, it sends fine hyphæ into the underlying wood. Utterly different is the usual method of behaviour of certain other fungi attacking the wood of living trees or felled timber. These, having once penetrated the wood, develop mainly inside this, growing in various directions but keeping at some distance under the surface except when producing fructifications; their advance is consequently slow compared with the rapid covering of the surface executed by *Merulius*, *Coniophora*, and *Polyporus vaporarius*. By means of its superficial mycelium *Merulius lacrymans* can advance far over innutritious surfaces, such as brick-walls, along metal tubes (for bell-wires, water), and can even penetrate the mortar of walls, and thus gain entrance to other rooms. In this manner, especially by means of the skin-like mycelium or of the string-like strands (often many yards in length), infection is transmitted to distant wood-work. Similar cords are possessed by *Polyporus vaporarius* and *Coniophora cerebella*, those of the latter being very abundant and familiar as slender, often nearly black, threads branching over moist, decaying wood in buildings.

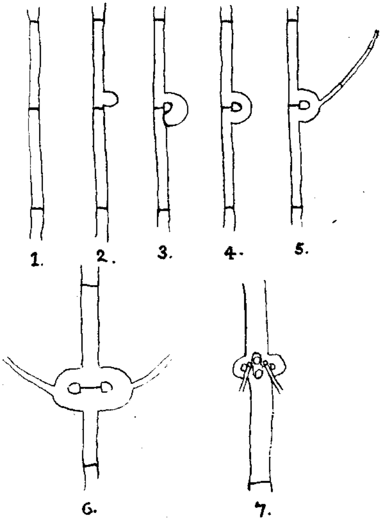
These fungal cords, apart from giving strong *primâ facie* evidence of the presence of the dry rot, are of practical importance in that they possess greater powers of resisting drought than other growths of the fungus (though I do not find the powers so great in *Merulius* as is usually alleged). In addition, as their structure varies with the species they aid in the identification of the *particular* species of fungus present.

In *Merulius lacrymans* such a cord shows three different kinds of tubular hyphæ:—(1) ordinary hyphæ, of normal width and normal thickness of cell-wall; (2) very wide, long tubes, comparable with the vessels of flowering plants, and serving to convey water containing nutritive material; (3) strong, fibre-like hyphæ, whose thick walls enable them to act as mechanically strengthening constituents. Without going into details, it may be stated generally that the older accounts with reference to the structure of the cords of the different species are not correct, and that the broad differences are quantitative rather than qualitative. For instance, *Polyporus vaporarius* has only very scanty vessel-like hyphæ, but very abundant fibre-like ones, so that even when old and dry its cords are tough, not brittle as are those of *Merulius lacrymans*.

Other features in the mycelia facilitate the recognition of the different kinds of fungi. While the cords of *Coniophora* are characterised by their very early assumption of a brown

when growing in a confined space has the nuique character of undergoing a *subsequent* change to a bright yellow colour.

Differences are also found in the minute structure of the mycelium, notably in the so-called "clamp-fusions" or "buckle-fusions" that take place between the consecutive segments of the hyphæ constituting the loose superficial mycelia, but to distinguish these the microscope is necessary. Here, again, the older



Diagrams of highly magnified hyphæ of fungi causing dry rot. (In these diagrams the relative dimensions of the constituents are not necessarily natural).

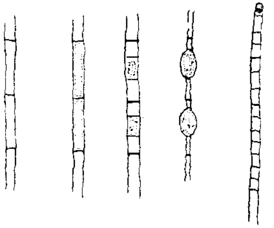
FIGS. 1–4.—Development of a clamp-fusion. [FIG. 5.—Clamp-fusion bearing a branch. FIG. 6.—Two opposed, branched clamp-fusions. FIG. 7. —Clamp-fusions and branches (reduced) of *Coniophora cerebella.*

statements are not quite correct. Diagrams 1-4 show the mode of production of such a clamp-fusion. In *Polyporus vaporarius* the clamp-fusion nearly always remains as is shown in Diagram 4, but in *Merulius lacrymans* it frequently emits a branch as depicted in Diagram 5; but in some cultures of these two species the conditions are entirely reversed. Again, in the latter fungus it is rare to find more than two (or at most three) clamp-fusions at the same level (Diagram 6), while the clamp-fusions of

Coniophora cerebella are arranged in very characteristic rosettes (Diagram 7), and inserted *between* them are branches, so that the hyphæ concerned show quite peculiar patterns (which, however, occur in some other kinds of fungi).

In order to correct a prevalent impression it may be mentioned that all three species of fungi here discussed contain many nuclei in the mature segments of their hyphæ (older statements alleging that only two occur in *Polyporus vaporarius*).

The specialist may further identify the kind of dry rot present by observing the growth of the young fungi and of the fungal threads emerging from infected wood.



8. 9. 10. 11. 12.

Diagrams of highly magnified hyphæ of fungi causing dry rot. (In these diagrams the relative dimensions of the constituents are not necessarily natural).

FIGS. 8–11.—Production of gemmæ in *Merulius lacrymans*. FIG. 12.—Production of oidia.

Spores are also produced by the fungi quite apart from the fructifications. *Merulius lacrymans* growing on a feeble nutritive medium produces in its hyphæ spores that are termed *gemmæ*. In such a case the living substance (protoplasm) of the segments of the hyphæ contracts towards the middle of each segment, becomes shut off by new cell-walls from the terminal deserted parts, and thus gives rise to the gemma. (Diagrams 8–11.) Possibly the infectious power of old, thoroughly dried wood containing this fungus is due to such gemmæ that have arisen inside the wood. *Polyporus vaporarius* and *Coniophora cerebella*, on the other hand, produce on their hyphæ continuous strings or rows of spores, known as *oidia* (Diagram 12), which are distinguishable from the gemmæ by reason of the fact that they are not separated from one another by collapsed empty segments. *Coniophora* occasionally also has rounded little spores, each solitary and forming the tip of a hypha.

Conditions Favourable to Dry Rot Fungi.—The fungi causing dry rot are active or even existent only when certain conditions are present.

Moisture.—Wood-destroying fungi during activity demand appropriate supplies of water and oxygen; such fungi cannot grow inside wood except when it contains moisture within certain limits. These limits vary with the species, though they seem to be approximately constant in range for one and the same species. On the one hand *Coniophora cerebella* requires that the wood shall be thoroughly moist, and is, therefore, most frequently found in damp cellars (and in Germany is termed the "cellar fungus"). This characteristic is so marked that the mere presence of this fungus suffices to indicate excessive dampness in a building. As an interesting example of this I may cite a case which came under my own notice in which wood taken from the roof was infected with *Coniophora cerebella,* so that it was possible to foretell the presence in the roof of a defective spot through which rain-water could directly enter. On the other hand, *Merulius lacrymans,* when it has once gained a footing, can grow in the driest wood. This remarkable faculty *Merulius* owes to its power of producing water, which is to be seen on the tips of its exposed hyphæ and is responsible for the specific name *lacrymans.* This water is not pumped out, as in the case of the leaves of plants, but is the result of specialised chemical activity. The fungus indirectly converts portions of its main food-material, wood, into carbon-dioxide and water. The same kind of respiration resulting in the production of relatively large supplies of water is encountered among animals, including meal-worms and the larvæ of the clothes moth and of certain wood-tunnelling beetles, all of which feed upon very dry material. *Polyporus vaporarius* possesses the same power, but to a less extent than *Merulius.* It is largely this high power of adding moisture to dry wood that renders *Merulius lacrymans* the most malignant source of dry rot in this country. When the fungus has attained a certain size local shortage of water leads to the production of cords and skin-like mycelia on exposed surfaces, as well as of fructifications.

Temperature.—The fungi causing dry rot in this country are also considerably affected by temperature. *Merulius lacrymans* and *Polyporus vaporarius* both behave as plants thriving only at moderate temperatures; according to R. Falck the highest temperatures at which the normal domestic form of the former will grow is between 26° and 27° C. (79°–80° F.). The mycelia of both species are rapidly killed by exposure to a temperature of

only 40° C. (104° F.), so that wood infected by them can easily be sterilised by heat that does not damage it. Spores and the fungi themselves are rapidly killed by steam. The resistance to low temperatures is greater, for *Merulius* can endure freezing cold.

Measures of Control.—The various kinds of fungi causing dry rot show widely different powers of attacking different timbers. At the one extreme stands *Merulius lacrymans*, capable of destroying the sapwood and heartwood of many kinds of "soft-woods" and "hardwoods," ranging from ordinary pine to resistant teak. At the other extreme is *Lenzites saepiaria*, which causes decay only in softwoods (conifers) and especially pine. The virulent versatility of *Merulius lacrymans* in this respect aids in rendering it the most dangerous destructive agent of woodwork in buildings.

In adopting practical measures to deal with dry rot it is necessary to distinguish sharply between measures to prevent its access and the graver problem of dealing with cases that have already broken out. In both instances a knowledge of the identity and behaviour of the fungi concerned is of paramount importance, but unfortunately at present this knowledge is very incomplete.

The first obvious preventive measure is to guard wood against contact with infectious material, including spores. Now the domestic form of *Merulius lacrymans* never grows on the wood of living trees, and, judging by the facts of the case in Germany, is very rare in woodlands, though there is a woodland race of this fungus that is not so uncommon. Original infection of wood in houses by this form of dry rot must probably be traced in the overwhelming majority of cases to the timber yard or builder's yard, or neighbouring buildings; and great carelessness in this direction is often displayed, for I have seen large, living specimens of *Merulius lacrymans* lying close against large stacks of timber in London. Lack of proper sanitation in places where sawn wood is stored, and carelessness in allowing the diffusion of infected material removed from buildings, are responsible for the original infection in probably the majority of cases. *Polyporus vaporarius* and *Lenzites saepiaria*, on the contrary, occur freely in woodlands, and especially on dead branches or fallen trunks, or stumps of trees.

A second means of prevention of infection is to deprive the fungi concerned of the conditions favourable or essential to their development. Among such measures are those designed to keep the wood dry, such as the use of well-seasoned wood and its

protection from wet during building operations, and afterwards by adequate ventilation. Other devices are: to check the rise of moisture up walls or its condensation on the latter; to avoid the use of pugging or other material that will attract or store moisture, or is partly composed of material upon which fungi can feed. Such precautions directly keep at bay fungi, such as *Coniophora cerebella*, that require definitely moist wood, but they also, indirectly, greatly decrease the chances of infection by *Merulius lacrymans*.

The antiseptic treatment of wood constitutes a third means of protection. Absolute protection can be thus secured only by thoroughly impregnating timber with an antiseptic, but the cost and difficulty of such treatment usually places this out of court. Coatings of a suitable antiseptic, however, very greatly decrease the chances of infection of sound wood. No antiseptic is yet known which is perfectly satisfactory in the case of dwelling-houses. As a means of guarding against *Merulius lacrymans* the following substances often recommended may be dismissed at once; copper sulphate, iron salts, zinc chloride, mercuric chloride (very poisonous and volatile). Creosote and even tar are effective, but their odour and colour restrict their use. Among inorganic substances boric acid, and above all, magnesium fluosilicate may be recommended. Among organic substances the first place must be given to the dinitro-phenates and dinitro-cresates of potassium or sodium. The most effective of all is (according to R. Falck) 2: 4 sodium dinitro-phenate, but this washes out and decomposes in the presence of light if used out of doors; moreover, it is explosive and, therefore, requires to be mixed with an inert substance.

It is advisable first to ascertain the nature of the fungi before adopting remedial treatment. They may be practically harmless, *e.g.*, species of *Coprinus*. Even when the woodwork itself is vigorously attacked, however, the measures to be adopted vary with the kind of fungus present. For instance, the rotting of the wood may be due to *Lenzites saepiaria*, which limits its attack to soft woods, especially pine timber, and is probably confined to a single piece of wood, since it spreads only *internally* in the wood and does not grow over the surface. In such a case the removal of the single piece of wood infected and its replacement by sound wood, preferably not a "softwood," may suffice.

Where the presence of a serious attack of dry rot has been established more drastic methods are essential. Not only must the infected wood be removed, but the adjoining woodwork

showing no external signs of decay should be tested. In extreme cases it may ultimately involve less loss to destroy rather than repair the whole building. In less severe cases, however, after the removal of the infected wood, the exposed surfaces (walls, woodwork, and sub-flooring) should be disinfected. A blast flame applied to the brick or stonework serves to sterilise the surface, and treatment for a sufficient length of time will kill parts of the fungus that have penetrated for some distance into the mortar. A wash of dilute formalin, or dilute corrosive sublimate, serves to kill spores and fungus on the surface; both these substances are useless for prolonged protection of the woodwork, as the former evaporates, and the latter volatilises; of the two, formalin is preferable because its vapour has a powerful lethal action on spores. Finally the wood, especially at the ends, should be coated with the antiseptic selected, which, preferably, should also be applied to the brickwork and so forth. In addition to these measures all practicable steps (proper ventilation, suitable pugging) should be taken to keep the wood as dry as possible.

In conclusion, it may be remarked that our knowledge of dry rot, especially so far as Great Britain is concerned, is in its infancy; yet the subject is one offering a field of research wide in range and national in importance: for (especially if we include the "dry rot" causing the destruction of timber in coal mines) the annual loss in the United Kingdom alone amounts to millions of pounds sterling.

STUDIES IN THE PHYSIOLOGY OF PARASITISM.

W. BROWN, M.A., D.Sc.

Introduction.— The physiological relations of host and parasite is a subject urgently in need of investigation at the present time. On a knowledge of such relations must depend any further insight into the nature of immunity and susceptibility of plants to disease. In the case of the more highly specialised parasites there is considerable difficulty in studying their physiological relations with their host owing to the complexity of the relationship, and to the difficulty of growing the parasites independently and of bringing about infection at all times of the year. It seemed probable, then, that a closer investigation, by modern biochemical methods, of the mode of action and method of infection of some of the simpler parasites which can be easily cultivated would be of great value. A knowledge of the relationship of such forms to their hosts should lead the way to a better understanding of the more highly specialised parasites.

Botrytis cinerea, the fungus employed in the present investigation, is a member of that large group of parasitic fungi which are characterised by the fact that they kill the tissue of the host plant in advance of their growth. This species was selected for the present work on account of its ubiquity, the readiness with which it reproduces itself, the rapidity and certainty with which its spores germinate, and the strongly marked features of its parasitic attack.

It was decided to start the investigation with a thorough study of the behaviour of an extract of the fungus, for, since death of the host tissue occurs in advance of the hyphæ, the poisonous and destructive action of the parasite is obviously due to substances excreted by the fungus. An extract made from the fungus under proper conditions should contain the active substance or substances by means of which the fungus works, and the extract when injected into the plant should produce the same effects as the living fungus; this was found to be the case.

Preparation of the Fungal Extract.—In order to obtain a strong preparation of the active principle of the fungus a method was developed which ensured the simultaneous germination of a very large number of spores in the culture medium. The germinated spores were then washed, dried, and ground to a powder. The powder was finally extracted in water and a clear extract obtained by centrifuging off the débris.

Effect of Fungal Extract on Plant Tissues.—The method of experiment consisted in placing pieces of plant tissue in the extract. In the case of leaves and floral structures it was found advisable to inject with the extract, as otherwise the action only proceeded slowly from the cut surface inwards. Injection was brought about under the air pump, or by means of a hypodermic syringe. The advantage of the latter method is that injection may be brought about while the leaves, petals, etc., are still attached to the parent plant, so that the parts injected are kept in a more normal condition during the period of the experiment. Experiments in which the leaves, etc., were injected with water served to control such injurious effects as might be produced by the process of injection.

In all cases the action of the extract was found to be of a two-fold nature: (1) An action upon the cell-walls of the plant resulting in the complete disorganisation of the cell-wall structure, so that the cells separate readily from each other, and the cellulose envelope of each individual cell becomes disintegrated and "mushy"; (2) an action upon the living cell itself, resulting in its death.

The former action is shown by the tissue losing its coherence. Thus, after a short treatment (about half an hour) with the extract, discs of potato or turnip tissue readily fall to pieces on handling. A similar rotting effect is produced in the case of many foliar and floral structures. In the case of some petals the action is extremely rapid, the injected part becoming limp and obviously disorganised within a few minutes of injection.

The killing action of the extract is shown variously in different cases. In the case of coloured structures it is shown by the escape of the colouring substance from the cells on death. Thus, petals of rose, viola, gloxinia, etc., on treatment with the extract, rapidly become decolourised. In other cases death of the cells is shown by the development of a colouration which is held in abeyance as long as the cells are alive. Thus, when leaves of broad bean are injected with extract they rapidly become black; when lettuce leaves are similarly treated they become brown.

The action of the extract has been tested in this way on a large number of plant structures. The following general conclusions are drawn:—

Fleshy structures are very generally susceptible to the action of the extract. Among such have been tested the tissue of potato, turnip (swede and white), radish, apple, cucumber, and a number of succulents (species of stonecrop, cotyledon, etc.).

Petals and floral structures, generally, are rapidly destroyed. Upwards of thirty species of plants have been tested in this respect, and in all cases a rapid destructive action on the part of the extract has been established. It is highly probable that this behaviour is characteristic of floral structures generally.

Among ordinary foliage leaves a strong action of the extract could be established in some cases, *e.g.*, leaves of broad bean, lettuce, violet, various species of begonia, petunia, etc. In other cases the action was of a much less marked character; with leaves of a leathery or woody texture it was not found possible to demonstrate any action whatever on the part of the extract.

The extract, so far as could be seen, had no action whatever on tissues of mosses or liverworts. It was also without action on filaments of algæ and on bacteria.

In all the cases examined the effect of the extract on the plant was found to be identical with that of the fungus itself. Also, wherever the fungus was able to attack a particular plant it was found possible to demonstrate a similar action on the part of the extract; and where the extract was without action (*e.g.*, mosses and liverworts) no definite action could be estab-

lished on the part of the fungus itself. From this it may be concluded that the extract employed contains all the substances which enable the fungus to attack the host tissue.

Behaviour of the Fungal Extract to Reagents.—An examination of the effect of various substances upon the activity of the extract was carried out. The main results arrived at were as follows:—

Acids and Alkalies.—The standard extract employed shows a slight acid reaction. When this is slowly diminished by careful addition of alkali, the activity of the extract diminishes, and finally becomes *nil* in the neighbourhood of the neutral point. In alkaline solution the action is in all cases inhibited. On restoring the extract to its original faintly acid condition its activity is restored. With increasing concentrations of acid the activity of the extract again diminishes, the effect of mineral acids being in this respect more marked than that of organic acids. Thus the maximum activity of the extract is shown in faintly acid solution.

Salts.—Addition of salts to the extract results in a diminution of activity. The specific retarding action varies with different salts, that of magnesium sulphate, for example, being much greater than that of potassium nitrate.

Plant Juices.—In accordance with the above, it was anticipated that plant juices would, on account of the presence in them of various acids, salts, etc., tend to retard the action of the extract. It was, therefore, of interest to determine how far the resistance of a particular tissue to the action of the extract (and of the fungus itself) could be correlated with the retarding action of its juice upon the activity of the extract. The juices of highly susceptible tissue—*e.g.*, potato, turnip—and of highly resistant tissue—*e.g.*, liverwort—were compared in this respect. It was found that the retarding action of the latter was quite comparable with and in no respect more marked than that of the former. The conclusion arrived at, therefore, was that the resistant power of a particular tissue to the action of the fungus (and fungal extract) was not directly related to the chemical nature of its cell sap.

In all cases observed it has been found that the two manifestations of the activity of the extract—namely, action upon cell-wall and action upon the cell-contents themselves—are inseparably connected. The cell-wall dissolving activity of the extract may be destroyed in various ways (by heating, by neutralisation with alkali, by mechanical agitation). In such cases it was always found that the action of the extract upon the living cell-contents was also destroyed. Death of the cells was invariably found to

follow the disintegration of the cell-walls; on the other hand, if the cell-wall was not affected, neither were the living contents of the cell. In other words, it would appear that the key to the resistance of a particular tissue to the action of the fungal extract is to be found in the chemical constitution of the cell-wall.

Entrance of Fungus into Host Plant.—The extract used in the present investigation is without action on plant tissue when placed on the uninjured surface of the plant—in other words, it is unable to penetrate the protective outer layers (cuticle). Neither is there any evidence that the fungus possesses any power of altering the outer protective covering of the plant in such a way as to allow of the penetration of its active principle. It follows, therefore, that the active principle of the fungus cannot come into play until actual penetration has taken place. The mechanism of the process of penetration, in particular the power possessed by fungi of penetrating membranes mechanically, is at present being investigated.

In order that the fungus may be able to penetrate a particular plant a certain amount of nutriment is required. An examination of the amount of nutriment available for the fungus in different cases is being carried out. It is believed that the variation of this factor in the case of different plants is largely responsible for their varying degree of resistance to the attack of the fungus.

By the development of the methods employed in the present investigation means will be available for attack on the important problems of immunity and susceptibility in connection with more highly specialised parasites.

(A fuller account of the work described above will be found in the *Annals of Botany*, Vol. XXIX., pp. 313–348.)

Broom-rape.

A NUMBER of cases which have come before the Board show that the parasitic weed Broom-rape (*Orobanche minor*, Sutt.) is unusually prevalent in clover fields this summer. The reason for this probably is that the last two seasons have been specially favourable to the germination in quantity of dormant seeds which would have otherwise germinated irregularly, seeds of Broom-rape having been stated by more than one authority to lie in the soil for years without losing their vitality. As pointed out in the Board's Leaflet No. 226 (*Broom-rape*) the species *O. minor* is parasitic on certain species of clover, and occasionally one or two other plants, the roots of the parasite attaching themselves to the roots of the host plant and subsisting on the food material

elaborated by the latter for its own use.* The result may be that considerable damage is done to the cultivated crop. Broom-rape is illustrated on p. 480.

Though it is not impossible for the seeds of Broom-rape to be sown with the clover or the "seeds" mixture, they are so small as to be readily removed by sifting in the process of cleaning, and are consequently seldom found in "seeds." In this connection the following passage in a Swiss official leaflet may usefully be quoted†: "Because foreign red clover is often badly infested with Broom-rape one now and then hears the opinion expressed that the latter is introduced with foreign clover seed. This is not so. In the many thousand clover-seed samples which have already been examined, the seeds of Broom-rape have never been found. This is easily understood. Broom-rape ripens its seeds much earlier than red clover. By the time the clover is harvested for seed the last of the parasite has distributed all its seed. Even if it did get into the clover seed, it would, on account of its small size, be completely removed by the clover-cleaning machinery. *Where Broom-rape appears, its seeds were certainly present in the soil.*"

In regard to the life-history the seeds only germinate on coming into contact with the roots of a host plant. The Swiss leaflet referred to states that "when the summer is warm and dry the seedlings grow rapidly in the first year, building up until autumn an onion-shaped, scaly rootstock with a large number of roots, which endeavour to attach themselves to other clover roots. No shoots come above ground in the first year, but they appear in the second year, after the clover is cut. Owing to the storing up of food in the clover plants after the clover is cut, and the extra warmth of the now bare soil, growth of the Broom-rape is very rapid, and the flowers appear in a few days. In an extraordinarily short time the seeds are ripened and distributed by the wind." Flowering occurs between June and October, and it is commonly the second cut of clover which is found to be so much attacked by the pest.

Farmers have inquired if Broom-rape is poisonous. It is not definitely known to be so, but has been suspected of having poisonous properties, and according to Boitel is liable to cause violent colic when it occurs in considerable proportion in clover, and is ingested with it§.

* An account of Broom-rapes, with description and life-history, was given in this *Journal* for June, 1908, p. 176, together with a coloured plate of *O. minor*. See also Leaflet No. 226.

† *Flugblatt Nr. 5, Schweizerische Samen-Untersuchungs und Versuchsanstalt Zürich.*

§ *Des Plantes Vénéneuses*, Ch. Cornevin, 1887.

The measures to be adopted against Broom-rape may be summarised as follows:—

1. Clean seed, free from the seeds of Broom-rape, should be ensured.

2. The plants may be hand-pulled after rain, before the seeds

a—BROOM-RAPE (*Orobanche minor*, Sutt.), nat. size; *b*—Seed of Broom-rape, nat. size and magnified; *c*—Seed of *Trifolium pratense*, nat. size and magnified.

ripen, when the Broom-rape may come up readily. Persistence may be necessary, however; Stebler quotes a case in which after plants had been removed by hand the pest again shot up, and though a workman devoted a fortnight solely to pulling up the Broom-rape he could not master the pest.* All plants removed should be burnt. If allowed to come to maturity the seeds will be scattered broadcast in large quantities.† Sorauer says that in case of widespread infestation prevention of seeding is the chief method of combating Broom-rape, because spreading by shoots or scions is slow and easily preventable by uprooting the plants.‡

3. Clover should not be grown on badly infested land until after the lapse of a number of years.

4. Manures which will encourage the growth of the clover, and aid it in resisting attack, may be employed with advantage. For example, ground lime and potash manures judiciously applied may be of value in this way.

5. Red clover when badly attacked by Broom-rape may be replaced by lucerne or sainfoin, which are much less commonly attacked than clover. The sowing of Italian rye-grass with clover has been found useful, as it grows rapidly after the first cut and retards the growth of the Broom-rape. Heavy-yielding varieties of red clover are valuable, their strong, luxuriant and rapid growth tending to suppress the parasite.

Directions for Preparing Manure from Peat.

THE following note has been communicated to the Board by F. E. Weiss, D.Sc., Professor of Botany in the University of Manchester:—It is not usual to review a publication issued a hundred years ago, but the interest which has been taken in the Manchester scheme for manufacturing bacterised peat may serve as an excuse for drawing attention to a pamphlet published in 1815, and bearing the title *Directions for Preparing Manure from Peat.* The anonymous author had already previously printed and distributed in the form of a tract his discovery that common peat was convertible into a putrescent manure, equally powerful as farmyard dung for the cultivation of ordinary crops, giving instructions for conducting and accomplishing the process requisite for that purpose. The author, a large landed proprietor in Scotland, having occasion to

* *Landwirtschaftliches Jahrbuch der Schweiz*, 1911, Heft 2, p. 166.

† The seeds are exceedingly small and light, almost dust-like, and several hundred are produced by a single flower.

‡ *Pflanzenkrankheiten*, Dr. Paul Sorauer.

scoop out from a hollow a quantity of peat moss in order to provide a space for a small artificial lake, found himself in a difficulty when faced with the problem of disposing of the mass of peat thus obtained, and being of a shrewd and practical turn of mind he tried a variety of experiments with a view of converting it into a manure. The experiments were undertaken in a truly scientific spirit, with a considerable insight into the nature of peat, and with as good a knowledge as was available at the time of the process of putrefaction as observable in the decay of animal and vegetable matter. Recognising in the deposits of peat the accumulation of vegetable matter in a state of partial decay, the author noted that in its natural state further putrefaction was inhibited, and he supposed that this was due to the evolution of tannin and gallic acid which had been detected in it. "Peat," as our author tells us, "when taken out of a bog is certainly not manure. If dried it becomes fuel, and so remains if kept dry. But if exposed to the vicissitudes of the atmosphere in our climate, it becomes, in the course of years, a sort of vegetable mould; and, if mixed with the soil and cultivated, raises good crops of potatoes and other vegetables."

How to accelerate this process was the object of his experiments extending over six or seven years. He first tried the effect of mixing the peat with substances that would neutralise its acidity; but peat mixed with lime for 12 months and used as a top dressing did no good for several years. He next mixed the peat with various forms of decaying vegetable and animal matter, and found that the putrefaction of these substances was communicated to the peat, setting up fermentative activity indicated by the rise in temperature, and resulting in the production of a rich compost, very effective in the raising of crops. In the earlier experiments he used such substances as the refuse of fisheries, shamble dung, etc., and in 1802 he had already announced a successful experiment by which he produced 10 tons of rich compost from peat made up with shavings of timber and the carcass of a horse, partly with, and partly without the addition of some old lime rubbish. The method he advocates in the pamphlet of 1815 as the simplest and most useful to farmers, however, is the mixing of peat with about a third of its weight of ordinary farmyard manure. The peat should be allowed to dry for a few months before carting. Then after spreading a layer of 6 in. of peat, about 10 in. of dung may be placed above the peat, then another 6 in. of peat, followed by four or five of dung. After a third layer of peat and dung, the whole should be covered with peat, making a heap about 4 to 4½ ft. in

height. In mild weather, seven cart-loads of tolerably fresh farm-yard dung is sufficient for twenty-one cart-loads of peat moss, but in cold weather a larger proportion of dung is required. It is useful to add about half a load of slaked lime, or about a load of ashes, but neither of these is essential. When the compost is thus made up it gets into heat in summer in less than a fortnight. If it gets too hot, it should be watered or turned over, and in doing this a little more peat can be added to the heap. When the heat subsides, it will be found that a very perfect compost has been formed, all the lumps of peat having been broken up. Used weight for weight, it will be found quite as good as farm-yard manure.

Peat made up with sea-weed heats, and appears to undergo the same changes as when prepared with dung. It has proved equally efficacious in raising wheat, but does not promote such early ripening of the grain. Made up in this latter way, two natural products which are usually allowed to go to waste may be used for enriching our crops, and where both are easily obtainable, advantage should be taken of their accessibility.

Our author's experiments proved successful, and his directions were circulated by many large Scottish landowners among their tenants. It would be interesting to know to what extent the practice was adopted, and to what extent it has been kept up in Scotland. The growing scarcity of dung, which is likely to increase with the further development of mechanical methods of traction, may resuscitate this discovery of a bygone age, at all events in those districts in which peat can be had practically for the cost of cartage. Apart from this possibility it is not without interest to find that experiments made so long ago as the commencement of the last century showed without doubt that peat, consisting as it does, of partially-decayed vegetable debris, contains the basis of valuable plant food, and if the latter can be rendered available to plants may become a useful manure.

In all probability, in the method recommended by our author, the acidity of the peat becomes neutralised by the ammonia contained in the dung, while decay-producing bacteria may percolate into the peat in addition to those normally contained in it, but whose activity is inhibited by the presence of humic acid.

In very much the same way, the peat in Chat-Moss has been in the course of years transformed into a rich black soil of great fertility. Drained of its acid waters and neutralised with lime, it has been further enriched, both in nutrient matter and in

decay-producing bacteria, by the addition of sewage, and has thus been rendered capable of promoting vigorous growth of crops. Now that the Manchester Corporation has undertaken to produce a manure from peat, it is to be hoped that, if it proves successful, it will once more draw attention to the possibilities of utilising the great peat deposits of the British Isles, which, in this scientific age, should surely not be allowed to remain an unused, and, therefore wasted store of plant-food.

Notes on Feeding Stuffs in August: *From the Animal Nutrition Institute, Cambridge University.*

THIS month's notes include the usual tables of composition and prices. Several small errors have been corrected. At the suggestion of a correspondent who was good enough to forward samples of ordinary and broad brans, analyses have been made of these feeding stuffs, with the following results (per cent.):—

	Water.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
Ordinary Bran..	13·40 ..	13·55 ..	4·47 ..	52·60 ..	10·71 ..	5·27
Broad Bran....	13·85 ..	13·15 ..	3·38 ..	53·64 ..	10·45 ..	5·53

These figures show that ordinary bran and broad bran are so nearly alike in composition that it is not worth while to work out separate figures for their digestible constituents and food units. For all practical purposes they may be taken as identical. In spite of this the average price of broad bran is nearly £1 per ton, or $1\frac{3}{4}d.$ per unit higher than that of ordinary bran. It is difficult to understand why broad bran should command this special price.

Prices.—Changes in price this month are very irregular. For the most part all kinds of cakes are slightly cheaper, but ground nut cake is dearer by $\frac{3}{4}d.$ per unit. Starchy foods, such as rice meal, maize, and maize meal, are dearer by $1d.$ to $5\frac{1}{4}d.$ per unit; bran has gone up in price on the month by $1\frac{3}{4}d.$ per unit, and broad bran by $2\frac{1}{4}d.$ per unit. Other materials, except treacle, which is much cheaper, have changed very little in price. Oats and barley are still so dear as to be practically prohibitive, except for very special purposes.

Rations.—*Horses.*—A suitable and economical ration for supplementing green food at harvest time is 3 lb. maize gluten feed and 4 lb. of bran, which are equivalent in feeding value to 8 lb. of oats. A full ration for horses which are called upon for hard work and long days in harvest is $4\frac{1}{2}$ lb. maize gluten feed, 6 lb. bran and $1\frac{1}{2}$ lb. crushed beans, which are equivalent to about a stone of oats. A word of warning on the subject of watering

horses during harvest may not be out of place. When working hard and long, horses require considerably more water than at ordinary times. It is more than usually important to remember this when horses are working hard on a food less well tried than oats.

Cows.—A continuance of the recent hot weather will soon cause the pastures to dry up, and cows should be watched for signs of falling milk yield. This point is especially important now, for a fall in yield at this season is never recovered.

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of July.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soya Bean Cake	122·3	12	0	0		—		12	0	0		—	
Decorticated Cotton Cake	126·3	12	10	0	12	0	0		—			—	
Indian Linseed Cake ..	123·1	12	10	0	12	7	6		—			—	
English Linseed Cake ..	120·1	12	12	6	13	5	0	12	10	0	13	2	6
Bombay Cotton Cake ..	65·3		—		9	10	0	9	10	0	9	7	6
Egyptian Cotton Cake ..	71·9	9	8	9	10	5	0	10	5	0	10	2	6
Coconut Cake	102·6	10	1	3	9	15	0		—			—	
Palm-kernel Cake ..	96·1	8	1	3	8	2	6	8	5	0	9	5	0
Ground-nut Cake ..	145·2	*12	0	0		—		11	17	6	11	15	0
English Beans	99·5	12	0	0	13	1	4	12	6	4	12	4	3
Chinese Beans	101·2	11	18	0	12	12	0		—			—	
English Maple Peas ..	97·2	13	2	3		—		13	6	8		—	
English Dun Peas ..	97·2	12	6	8		—		12	4	5		—	
Calcutta White Peas ..	97·5	15	2	3		—			—			—	
American Maize	93·8	11	13	4	11	7	9		—			—	
Argentine Maize	94·2	12	2	8	12	8	3	12	16	8	12	9	8
Maize Meal	86·5	11	0	0	12	0	0	12	17	6	12	10	0
Maize Gluten Feed ..	121·6	10	15	0		—			—		11	10	0
Maize Germ Meal ..	99·2	10	15	0	11	5	0		—		11	15	0
English Feeding Barley ..	83·0	14	0	0		—		13	8	10		—	
English Oats	75·4	12	0	0	12	4	9	12	0	0	11	13	4
Argentine Oats	75·4	11	11	2		—			—		11	1	1
Malt Culms	69·9	7	0	0	8	0	0	6	15	0	8	0	0
Brewers' Grains (dried) ..	84·5	8	12	6		—		8	0	0	9	0	0
Brewers' Grains (wet) ..	21·1	1	1	0		—		1	10	0		—	
Distillers' Grains (English)	101·2	8	13	9	8	10	0		—		10	0	0
Distillers' Grains (French)	101·2	8	12	6		—			—			—	
Egyptian Rice Meal ..	78·7	11	0	0		—			—			—	
Burmese Rice Meal ..	78·7	10	0	0	9	15	0		—		10	10	0
Wheat Middlings (coarse)	94·8	9	0	0		—		8	5	0	10	15	0
Wheat Sharps	90·5	9	5	0	9	10	0	10	0	0	9	10	0
Wheat Pollards	96·7		—		7	17	6		—			—	
Wheat Bran	77·5	6	2	6	6	15	0	7	0	0	6	10	0
Wheat Bran (broad) ..	79·9	7	2	6	7	2	6	8	0	0	7	7	6
Feeding Treacle	60·0	10	15	0	12	10	0		—			—	
Linseed	153·5	20	0	0	†22	0	0	19	18	6	19	5	0
Linseed Oil	250·0	36	0	0	‡39	0	0	32	15	0	49	15	7
Egyptian Cotton Seed ..	108·6	13	0	0		—		13	15	0		—	
Bombay Cotton Seed ..	99·6		—			—			—			—	
Cotton Seed Oil	250·0		—		‡48	0	0		—			—	

* 2nd grade (London) £11 10s. 0d. per ton. † Cleaned. ‡ In barrels.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	0	Chinese beans	2	4¼
Wheat bran	1	7	English beans	2	5
Ground nut cake ..	1	7¾	Cotton seed	2	5
Palm-nut kernel cake ..	1	8¼	American maize.. ..	2	5¾
Distillers' grains (French)	1	8½	Burmese rice meal ..	2	6¼
Distillers' grains (English)	1	8¾	English dun peas ..	2	6½
Maize gluten feed ..	1	9¼	Maize meal	2	6½
Wheat bran (broad) ..	1	9½	Argentine maize ..	2	6¾
Wheat middlings ..	1	10¾	Linseed	2	7¼
Coconut cake	1	11½	Egyptian cotton cake ..	2	7½
Soya bean cake	1	11½	English maple peas ..	2	8½
Decorticated cotton cake	1	11¾	Egyptian rice meal ..	2	9½
Malt culms	2	0	Linseed oil	2	10¾
Indian linseed cake ..	2	0¼	Argentine oats	3	0¾
Brewers' grains (dried) ..	2	0½	Calcutta white peas ..	3	1¼
Wheat sharps	2	0½	English oats	3	2¼
English linseed cake ..	2	1¼	English feeding barley ..	3	4½
Maize germ meal ..	2	2	Feeding treacle	3	7

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Wheat pollards	1	7½	Burmese rice meal ..	2	5¾
Distillers' grains (English)	1	8¼	Chinese beans	2	6
Palm-nut kernel cake ..	1	8¼	Argentine maize ..	2	7½
Wheat bran	1	9	English beans	2	7½
Wheat bran (broad) ..	1	9½	Maize meal	2	9¼
Decorticated cotton cake	1	10¾	Egyptian cotton cake ..	2	10¼
Coconut cake	1	10¾	Linseed	2	10¼
Indian linseed cake ..	2	0	Bombay cotton cake ..	2	10¾
Wheat sharps	2	1¼	Linseed oil	3	1½
English linseed cake ..	2	2½	English oats	3	3
Maize germ meal ..	2	3¼	Cotton seed oil	3	9½
Malt culms	2	3½	Feeding treacle	4	2
American maize.. ..	2	5¼			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	English dun peas ..	2	6¼
Ground nut cake ..	1	7¾	Egyptian cotton seed ..	2	6½
Palm-nut kernel cake ..	1	8½	Linseed	2	7¼
Wheat middlings ..	1	9	Linseed oil	2	7½
Wheat bran	1	9½	Argentine maize ..	2	8¾
Brewers' grains (dried) ..	1	10¾	English maple peas ..	2	9
Malt culms	1	11¼	Egyptian cotton cake ..	2	10¼
Soya bean cake	1	11½	Bombay cotton cake ..	2	10¾
Wheat bran (broad) ..	2	0	Maize meal	2	11¾
English linseed cake ..	2	1	English oats	3	2¼
Wheat sharps	2	2½	English feeding barley ..	3	2¾
English beans	2	5¾			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	7½	Maize germ meal ..	2	4¼
Wheat bran	1	8¼	English beans	2	5½
Wheat bran (broad) ..	1	10	Linseed	2	6
Maize gluten feed ..	1	10¾	Argentine maize ..	2	7¾
Palm-nut kernel cake ..	1	11	Burmese rice meal ..	2	8
Distillers' grains (English)	2	0	Egyptian cotton cake ..	2	9¾
Wheat sharps	2	1¼	Bombay cotton cake ..	2	10½
Brewers' grains (dried) ..	2	1½	Maize meal	2	10¾
English linseed cake ..	2	2¼	Argentine oats	2	11¼
Wheat middlings ..	2	3¼	English oats	3	1¼
Malt culms	2	3½	Linseed oil	3	11¾

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	2½	American maize.. ..	2	5½
Ground nut cake ..	1	7¾	Egyptian cotton seed	2	5¾
Wheat pollards	1	7½	English beans	2	6
Wheat bran	1	8½	English dun peas ..	2	6¼
Distillers' grains (French)	1	8½	Burmese rice meal ..	2	6½
Palm-nut kernel cake ..	1	9	Argentine maize ..	2	7¾
Distillers' grains (English)	1	9¾	Linseed	2	7¾
Maize gluten feed ..	1	10	English maple peas ..	2	8¾
Wheat bran (broad) ..	1	10¼	Egyptian cotton cake ..	2	9½
Coconut cake	1	11¼	Maize meal	2	9½
Decorticated cotton cake	1	11½	Egyptian rice meal ..	2	9½
Soya bean cake	1	11½	Bombay cotton cake ..	2	10¾
Wheat middlings ..	1	11¾	Argentine oats	2	11¾
Indian linseed cake ..	2	0¼	Calcutta white peas ..	3	1¼
Brewers' grains (dried) ..	2	0¼	Linseed oil	3	1¾
Wheat sharps	2	1¼	English oats	3	2¼
English linseed cake ..	2	1¾	English feeding barley ..	3	3½
Malt culms	2	1¾	Cotton seed oil	3	9½
Maize germ meal ..	2	3¼	Feeding treacle	3	10½
Chinese beans	2	5			

Dry pasture is best supplemented by green soiling. Where this is not available, it may be replaced by a mash of equal parts of coconut cake and bran at the rate of 3 lb. of the dry mixture for each gal. of milk yielded per day above 2 gal.

If it is impossible or very inconvenient to prepare mashes, linseed cake and bran in equal proportions may be fed dry to the cows at the rate of 3 lb. per head per gal. of milk above 2 gal.

If the grass gets very much burnt, it may be desirable to give even the cows which give under 2 gal. a small feed as above, each time they are milked.

If the cows are accustomed to palm-nut kernel cake, this may replace linseed cake, and will be rather cheaper, but cows sometimes do not eat palm-nut kernel cake readily at first, and to keep up the milk yield at this time of year it is important to give them some kind of concentrated food which they will take to immediately.

Young Stock.—A mixture of linseed cake and bran at the rate of 2 lb. per head per day was suggested last month for pushing on the young stock. This may now be supplemented with ground nut cake at the rate of 1 lb. per head per day for animals under 9 months, rising to 2 lb. by the time they reach 12 months.

Lambs.—As last month.

TABLE VII.

(1) Name of Feeding Stuff.	(2) Nutritive Ratio.	(3) Per cent. digestible: Protein.	(4) Per cent. digestible: Fat.	(5) Per cent. digestible: Carbo-hydrates and Fibre.	(6) Starch equiv. per 100 lb.	(7) Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	*1 : 1·2*	*34·0*	*8·5*	*20·0*	*71·0*	93
Linseed cake, Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English. } *" " French* }	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake ..	*1 : 4·5*	*14·1*	*6·1*	*48·9*	*76·7*	*101*
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	*1 : 2·6*	*19·3*	*1·2*	*48·2*	*67·0*	*88*
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·5	73·1	96
Wheat sharps	1 : 5·1	11·6	3·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	*1 : 4·7*	*11·3*	*3·0*	*45·4*	*48·1*	*63*

Pigs.—Last month's suggestions may be repeated. The mixture of 7 parts of wheat sharps and 1 part of linseed cake then recommended is still the most economical feed for pigs. Its cost is now about £10 per ton as compared with barley meal at £14 per ton. Rye may be available in some districts, and is worthy of trial. Its feeding value for pigs is practically the same as that of barley meal, and at present prices it is rather more than £2 per ton cheaper.

Wheat has been used for pig feed recently. At present prices it works out at about £12 10*s*. per ton, which is cheaper than barley meal, but much dearer than the mixture suggested above.

Allotment Gardens in Stafford.*

THE borough of Stafford is well provided for in the matter of allotments. Exclusive of small vacant sites which are now being cultivated, some 90 acres are let out in allotments on various estates. Of these, by far the largest is the Stafford Freemen Allotments group, which covers 70 acres of ground, situated near Coton Hill. The use of this land was secured for Stafford freemen by a Local Act of 1880. The land is divided into 401 plots, allotted for life to resident freemen according to seniority, and the plots are cultivated by some 650 growers.

The administration of the allotments is in the hands of 12 elected trustees, who are empowered under the Act to grant the use of plots to freemen only, at a small rent, usually 2*s*. 6*d*. annually, including rates and tithe. When a freeman who has obtained an allotment does not wish himself to cultivate all or any of it, he often sub-lets the portion not required or even sells it for his life time; but under the rules framed by the Act and adhered to by the trustees, the sub-tenants are not in any way recognised by the trustees, and no complaints or claims for compensation are entertained from any allotment holders who are not freemen.

The allotments are generally cropped with potatoes. An outbreak of Wart Disease some years ago considerably handicapped the tenants who grew potatoes, but varieties have now been selected which are resistant to the disease and suitable to the district. In some cases the allotment holders devote their land entirely to the cultivation of roses and other flowers for sale. Vegetables, in some cases are produced for home consumption, in others, for

* In connection with this example, reference might be made to the suggestions for improving allotments, which appeared in this *Journal* for January, 1916, p. 958.

sale. Occasionally a local variety of apple or pear tree is to be found, but the tenants do not appear to be familiar with the more modern sorts.

It appears that artificial manures are little used, except by the more skilled gardeners, and there seems to be a total lack of co-operation among the holders in the purchase of manures.

Exhibitions or shows are popular with a few of the cultivators. Until last season an annual show was held in connection with these allotments, at which a prize of £20 was offered for the best cultivated plot. Subscriptions were also collected locally for further prizes. The position of the sub-tenants is such, however, that they do not take any great interest in these competitions.

It is stated that the estate is the largest of its kind in the county, and could easily be made a model allotment. In general, however, it appears that the enforcement of restrictions contained in the Act militates against complete success. It is provided that a freeman forfeits the right to his plot should it become neglected, but the system of giving notice to one tenant and establishing another is slow, and in the meantime admits of the plot becoming waste land, overrun with weeds, which do much harm to the surrounding allotments. The rules further lay down that no plough must be used on the estate. Finally, the non-recognition of sub-tenants, of whom there are a considerable number, does not offer them much inducement to expend on the land any money or labour which will not be quickly repaid, or to attempt permanent improvements, since their occupation is liable to be terminated at any time without their having any claim on the estate.

Carriage of Fruit and Empties.

IN view of the strain now falling on the railways, the Board of Agriculture and Fisheries wish to impress upon fruit-growers and salesmen the necessity of assisting the railway companies to avoid undue delay in the transport of fruit and empties by rail during the continuance of the war, by paying attention to the following points:—

1. Fruits should be sent to the most accessible markets in approximately regular daily quantities, and not rushed up in large quantities on particular days. The resources of the railway companies at the present time are not equal to dealing promptly with rushes of traffic. Whenever possible fruit should be disposed of locally.

2. The sorting of small lots into delivery vans, and the delivery of small lots, involves delay. Growers should put together their

consignments to salesmen in lots of 2 or 4 tons. Delivery will thus be expedited. In many cases a considerable reduction of the rate is obtained by pooling the consignments in this way.

3. In order to ensure the dispatch of fruit, growers should, where required, advise the station master or goods agent overnight of the approximate quantities they wish to forward the following day. This may be necessary, as, owing to shortage of labour, the railway companies frequently have to restrict the total quantity of fruit they accept for conveyance, and growers who do not give notice may find that it is impossible for their fruit to be accepted.

4. In view of the shortage of cartage, all salesmen should open their stands by the time the first deliveries of fruit are made by the railway companies and discharge the vans immediately. This is extremely important in the interests of the whole fruit industry. The detention of railway vans containing the earlier consignments of fruit may lead to the holding up at the stations of other consignments pending the return of the vans, and cause loss to salesmen and growers through late deliveries.

5. Baskets, mats and bags, marked with initials and consigned to persons other than those to whom the initials belong, should be separately labelled and addressed.

6. Salesmen should endeavour to bring their packages together so as to make full van loads for the different stations irrespective of the number of consignees at such stations. This enables railway companies to transfer the packages direct from van to truck without sorting at the station.

7. The requirement of the railway companies that "market" empties shall be tied in bundles of eight should be observed. Every bundle should be labelled with the consignee's name and address. Empties should be ready for collection early in the day, and should not be tendered during the late afternoon or evening.

8. Growers should clear empties from the country stations promptly. If the empties are allowed to accumulate at country stations, the available stock is reduced and the companies find it difficult to deal with empties that are urgently required.

9. During the war, salesmen should avoid sending empties to the country stations on the chance of finding a grower who will consign fruit to them.

10. Salesmen should be prepared to accept empties when tendered by the railway companies, and not only at certain hours or on certain days.

11. In order to relieve congestion in the London Markets, empties should, where practicable, in the case of considerable con-

signments, be returned direct to the grower instead of through the London Markets. The question in each case, however, is one for the railway company concerned, and they should be consulted in the first instance.

Profitable Poultry Keeping in Kent.

THE attention of the Board has been directed to an instance of profitable poultry-keeping on a holding in Kent, occupied by one of the station holders under the Board's scheme for distributing sittings of eggs of pure breeds of poultry (see *Journal*, November, 1915, p. 812). The stock of birds on 1st November, 1914, numbered 152; 28 were bought during the year ending 31st October, 1915, on which date the stock numbered 408. The eggs obtained during the year numbered 15,111. The following balance sheet shows a profit of £108 1*s*. 8*d*.

Balance Sheet (1st November, 1914, to 31st October, 1915).

	£	s.	d.		£	s.	d.
Food	97	13	4	14,231 eggs sold	104	3	9
4¼ cwt. oyster shell at 4s. 6d.	0	19	0	(880 eggs kept for sitting)			
Advertising	0	15	11	23 birds killed for own use	2	8	3
Bought 46 eggs for setting ...	0	9	0	369 birds sold	64	14	4
Creosote, about 42½ gal. at 6d,	1	1	9	66 infertile eggs at 1*d*. ... (included in 880 above)	0	5	6
Depreciation of appliances, 10 per cent.	2	6	8	Stock in hand ... ... (408 birds)	47	9	0
Value of stock on 1st Nov., 1914 (152 birds)	22	13	6	Food in stock	14	12	0
Stock bought (28 birds) ...	3	12	0				
Total expenditure ...	£129	11	2				
Profit	104	1	8				
	£233	12	10		£233	12	10

No rent is charged on this account, the ground being fully cropped with fruit and nut trees and the value of the manure being more than equal to any sum due as rent. In addition, the birds work the ground, and keep it free from weeds, thus saving a considerable amount of labour. The cost of attendance has not been included. It may be remarked that the appliances are largely home-made, and that hens are used for hatching purposes.

Successful Employment of Women in Agriculture.

A CASE has come to the notice of the Board in which the employment of two women on the land was attended with markedly successful results. The previous employments of the women in question were dressmaker and milliner respectively; neither had previously ever done outdoor work of any description, so that they were utterly unaccustomed

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to animals and heavy work, but they were anxious to take up farm work and were willing to attempt whatever was asked of them.

They were engaged early in March of the present year through the Labour Exchange by Mr. Lawson Wood, who farms 500 acres (of which 140 is arable, the rest being pasture and hops) at Docklow, Leominster. It was Mr. Lawson Wood's intention to train them to act as waggoners and do general farm work. They were engaged on a month's trial, the fare to the farm was paid, full board and lodging was provided (an empty semi-detached cottage was furnished rent free) and they were paid 8*s*. a week wages without any deductions. The wife of one of the old farm hands catered for them, provided all food, cooked, kept the house clean, etc., for which she was paid by the employer. The day's time-table was as follows: Rise at 6 a.m., breakfast, commence work at 7 a.m., dinner from 1 till 2 p.m., and cease work at 6 p.m.

For the first two or three weeks the weather was very bad, but the girls kept to their work in a most praiseworthy manner without complaint. Commencing with cleaning out cowsheds and stables they gradually progressed until they acted as waggoners, replacing the old waggoners in all respects except as regards ploughing.

The work these girls have done is as follows:—

Scuffling.—They commenced by leading one horse each, with a man driving the scuffle; later, each girl was put to leading three horses with men driving (this was in the hops), and, later still, they scuffled the whole of the oat crop, each with two horses, without any help.

Manuring.—They loaded the carts, took them to the land, unloaded, and spread the manure.

Ploughing.—They each led three horses with a youth ploughing.

They cleaned out stables and sheds, carried hay and straw to them, bedded down horses, fed them, cleaned them, harnessed and unharnessed them and tended them generally. They were not in the least afraid of the bulls, except at commencing.

The keenness and willingness of the girls promoted a healthy spirit of competition among the men, so that work has improved all round.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

SOILS AND MANURES.

Experiments with Farmyard Manure (*Jour. Ind. Engin. Chem.*, June, 1916).—These experiments were carried out at the Wisconsin Experiment Station with mixed fresh horse and cow manure freed from litter. Four lots, each of 25 lb. of the mixture, were taken and (1) left untreated, (2) mixed with 2lb. pine shavings, (3) mixed with 2lb. oak shavings, (4) mixed with 2lb. oat straw. At the beginning and at 2, 4, 8 and 12 weeks thereafter the lots were thoroughly mixed and sampled. The following results were obtained after 12 weeks:—

(1) The loss of total organic matter ranged from 33 to 51 per cent., being most rapid and greatest in the straw littered manure, where bacteria were most numerous.

(2) The water-soluble organic matter decreased continuously with a loss of from 60 to 80 per cent. of the original amount (the latter equal to 10 to 13 per cent. of the total organic matter), the loss being most rapid in the first two weeks.

(3) Humus (11 to 16 per cent. of the total organic matter) decreased by from 26 to 35 per cent., the losses from the littered manures being nearly equal and about one-third greater than from the control manure.

(4) The water-soluble ash (37 to 41 per cent. of the total ash) decreased gradually by from 14 to 30 per cent. of the amount originally soluble, the decrease being less in the straw-littered manure than in the other lots.

(5) The total nitrogen increased in all the manures until the fourth week of fermentation, the gains ranging from 8 per cent. of the original amount in the control manure to 20 per cent. in the straw-littered manure. After twelve weeks a net loss of nitrogen obtained, ranging from 3 to 13 per cent. of the original amount of nitrogen, and being less in the straw-littered manure than in the other manures.

(6) The water-soluble nitrogen, forming from 41 to 48 per cent. of the total nitrogen, decreased rapidly in all manures during the first four weeks, and suffered greater loss than any other constituent investigated. The losses ranged from 77 to 90 per cent. and were somewhat greater in the shavings-littered manures than in the other lots.

(7) Humus nitrogen, forming from 47 to 57 per cent. of the total nitrogen lost from 2 to 10 per cent., the loss being greatest in the control manure. The fluctuation was similar in all of the manures, the humus nitrogen decreasing 10 to 20 per cent. during the first four to eight weeks of fermentation and then gradually increasing.

Of the changes indicated above, the gain of nitrogen during the early stages of fermentation is the most important. In field trials with maize where fresh and stall manure, each made with (i.) wheat straw and (ii.) shavings, were used, it was found that the straw-littered-fermented manure produced about 10 per cent. greater yield of both maize grain and stover than did the corresponding shavings-littered manure, a difference which was in keeping with the total nitrogen changes obtained in the analytical investigation,

Green Manuring and Failure of Seedlings (*Jour. Agric. Research*, V. 25).—Green manures may seriously injure the germination of certain seeds; this injury is brought about by the action of certain parasitic

fungi. In the first stages of decomposition of green clover, numerous fungi develop ; some of these fungi are very destructive to seedlings.

Starchy seeds are very resistant to the fungi, and the germination of buckwheat, maize, oats and wheat is not affected by green manures.

Oil seeds on the contrary are, as a class, very easily damaged, cotton seed and soya beans being extremely sensitive. The germination of flax, ground nuts, hemp, mustard, and clover is reduced in the presence of decomposing plant tissue. The damage is confined largely to the first stages of decomposition ; no serious injury is caused two weeks after adding green manure.

Small applications of calcium carbonate seemed to increase the injury to germination.

The rate of germination determines to a certain extent the degree of injury. Slow germination is marked by a high percentage of diseased seedlings.

Improvement of Hill and Peaty Pastures (*Univ. Coll. of N. Wales, Dept. of Agric., Bull. III.*, 1915).—Experiments on the treatment of poor pasture on hilly or peaty ground were commenced in 1913 at 7 centres, an additional 8 centres being added in the winter of 1914-15. At each centre seven ½-acre plots received various manurial dressings. The results so far show that basic slag is likely to produce at least as good results as any other manure. Gafsa phosphate, a form of mineral phosphate, will, on sour, peaty soils, produce almost as good an effect as basic slag. Potash manure has not given a return at all commensurate with its cost, while lime and ground limestone, used alone, have had practically no effect on the herbage.

Calcium Sulphate and Sulphur (*Jour. Agric. Research*, 17th January, 1916).—The addition of calcium sulphate to the soil did not produce any marked effect on the bacteria commonly found on agar plates, but increased the growth of legume bacteria. It also increased the yield of red clover, which was accompanied by a greater root development and a greater number of nodules.

The addition of sulphur increased the ammonification, but decreased the nitrification and the total number of soil organisms. It increased the yield of red clover but slightly, and did not affect the root development or the number of nodules.

Bacterial Activity in Soils and Crop Production (*Jour. Agric. Research, V.* 18).—From this investigation a strong indication was obtained that certain bacterial activities in field soils are very closely associated with crop yields ; and it is concluded, tentatively, that the relative crop-producing power of several soils can be indicated quite accurately by laboratory tests of such bacterial activities.

FIELD CROPS.

Manuring of Swedes (*Univ. Coll. of N. Wales, Bull. VI.*, 1915).—Tests were carried out in 1913, 1914, and 1915 with the object of (1) comparing basic slag, superphosphate and Gafsa phosphate as manures for swedes ; and (2) of demonstrating the importance of phosphatic manures for swedes. The increased yield per acre obtained by the use of phosphatic manures supplying 200 lb. total phosphates per acre amounted to about 8 tons. Basic slag and superphosphate gave approximately equal results, and with the possible exception of dry soils containing considerable quantities of lime, basic slag may be safely substituted for superphosphate in the growing of swedes. The mineral

phosphate gave a yield of about 1 ton per acre less than basic slag and superphosphate and is more likely to prove of general value for poor pastures on peat or upland soils than for swedes on ordinary cultivated soils.

Manuring of Flax (*abs. Trudy po prikladnoj Botanikje*, April, 1916).—The conclusions drawn from experiments carried out for five years at the Engelgardt station (government of Smolensk) on flax after clover were that: (1) Potassic manures increase the yield of both seed and fibre, but there was very little difference in effect between ¼ cwt., ⅜ cwt., and ½ cwt. of potash per acre; (2) that nitrogenous manures alone, although increasing the crop, were not economically profitable; (3) that the application of superphosphates for flax after clover is irrational.

Experiments in the government of Vitebsk showed applications of manures in spring, and directly on the flax, to give better results than dressings in autumn or on the previous crop.

Size of Seed Potatoes (*Jour. für Landwirtschaft*, xxxvi., 1.).—Large and small seed potatoes of three varieties, "Six Weeks," "Egg," and "Up-to-date," were planted. The results indicated that large seed potatoes gave a greater number and weight of potatoes per plant than the small seed. The difference was greater among potatoes planted on unmanured, or little manured ground, than on fully manured ground, and also greater among early potatoes than late potatoes. Small seed, however, gave a greater yield per plant in proportion to the weight of the seed planted, and also grew a larger potato.

Teasel Cultivation in Russia (*abs. Trudy po prikladnoj Botanikje, April*, 1916).—The teasel is grown in Russia in the Crimea and in the governments of Minsk and Bessarabia; it usually follows a corn crop, but exceptionally a fallow. The period of growth is from 52 to 56 weeks (rather less than this on the Black Sea coast); the plant requires a warm climate, sheltered situation, and plenty of sun, although it stands a winter temperature of 5° F. in the first year. The crop on 1 acre may reach from 180,000 to 240,000 heads, with 9½ to 30 cwt. of seed and from 24 to 48 cwt. of stems and leaves; the gross return from the teasel heads may reach about £45 per acre, while the stems and leaves are suitable for fuel or litter or for potash extraction.

Samples of teasel heads grown experimentally at New Alexandria and in the Caucasus were pronounced by cloth manufacturers to be of good quality—better than heads of German or Austrian origin. Extension of teasel cultivation in Russia would destroy dependence on foreign sources, Russian manufacturers having thus spent tens of thousands of roubles in the past. (See this *Journal*, December, 1912, p. 738, for teasel cultivation in England).

Influence of Strontium and Boron on Wheat and Barley (*Jour. Roy. Agric. Soc.*, 1915).—The general conclusions drawn from experiments with strontium salts on wheat are:—

(1) That strontium in the form of the sulphate, the hydrate, and the carbonate, is, when given up to ·10 per cent., practically without effect either on the germination of the seed or the increase of the crop.

(2) That strontium, used in the form of nitrate of strontium, produces an increase of crop, but that this cannot be attributed to the presence of strontium.

(3) That strontium applied as strontium chloride has a retarding effect on germination, and, when used in quantity approaching ·10 per cent. of strontium, has a distinctly toxic effect.

The results obtained in experiments with boron compounds on wheat and barley are thus stated :—

(1) Germination is retarded when anything over ·003 per cent. of boron is used, and even ·001 per cent., more especially with borax, seems to delay germination.

(2) Anything over ·001 per cent. of boron either as boric acid or borax, will prevent plants from developing and forming grain.

(3) A toxic influence is shown with ·0005 per cent. of boron, but with quantities not exceeding ·00025 per cent. there is a slightly stimulating effect.

(4) The effects generally are more marked with borax than with boric acid.

Effect of Lime on Clover (*Massachusetts Agric. Expt. Sta., Bull. No.* 161).—This investigation pointed to the fact that the increased growth of clover obtained from the application of lime at the rate of 4,000 lb. per acre was caused by the effect of the lime on the soil constituents, by which the root environment was improved, rather than by any effect within the plants by the absorption of a large amount of calcium salts.

Toxic Effect of Iron and Aluminium Salts on Clover (*Massachusetts Agric. Expt. Sta., Bull. No.* 161).—The conclusions reached as the result of growing clover seedlings in culture solutions containing iron and aluminium salts were as follows :—

Aluminium sulphate when present in a greater proportion than 40 parts per million of aluminium, and ferrous sulphate when present in a greater proportion than 4 parts per million of iron, both exert a toxic effect on clover seedlings.

The toxic effect of iron and aluminium can, in a large measure, be overcome by the use of calcium carbonate up to a certain point, beyond which it has no effect; but calcium sulphate does not produce this beneficial effect.

The theory that the toxicity of iron and aluminium salts is due to their penetration into the seedlings did not appear to be borne out by these experiments, and there were indications that the toxic action was confined to the first layer or two of cells in the growing portion of the roots, thus causing the seedlings to die from lack of nourishment rather than from poisoning of the plants themselves.

LIVE STOCK AND DAIRYING.

Cattle Feeding (*W. of Scot. Agric. Coll. Bull.* 67).—In each of the winters of 1911–12, 1912–13, and 1913–14, 12 blue-grey and black bullocks were divided into three lots of 4 each which were fed for 70 days on 4–4½ lb. dec. cotton cake, 4–4½ lb. soya bean cake and a mixture of 3 lb. undec. cotton cake and 2–2½ lb. linseed cake per head per day respectively, in addition to the basal ration of 4–4½ lb. crushed oats, 4 lb. rye-grass hay, 72 lb. swedes and straw *ad lib.* Taking the average of the three years the dec. cotton cake lots made a live weight increase of 16 lb., the soya bean cake lots 14·3 lb. and the undec. cotton cake and linseed cake lots 13·2 lb. per head per week at costs per lb. increase of 1·91*d.*, 1·91*d.* and 2·45*d.* respectively. On the basis of the values per cwt. live weight at the end of the experiments the average weekly increases in value per animal, after deducting the cost of the cake, were, respectively, 7*s.* 5*d.*, 6*s.* 6*d.*, and 5*s.* 1*d.*

In a further experiment in the winter of 1914-15 with 12 animals, a mixture of 1 lb. dec. cotton cake and 2 lb. crushed oats was compared with 3 lb. palm-kernel cake and 4 lb. bran respectively; average weekly gains in live weight of 11·1 lb., 8 lb., and 7·2 lb. resulted from the three foods.

Milk Yields and Cost of Food (*West Sussex Milk Recording Society*).—The West Sussex Milk Recording Society started work on 1st October, 1914; between that date and 30th September, 1915, eleven herds were recorded, and 870 individual records were taken. Of the cows for which fullest records are available, 5 per cent. gave over 1,000 gal., 13·2 per cent. between 800 and 1,000 gal., 31·9 per cent. between 600 and 800 gal., 15·5 per cent. between 500 and 600 gal., and as many as 34·1 per cent. gave under 500 gal.

In ascertaining the cost of production the average price of bought foods for 1914-15 was taken; of home-grown foods, hay was priced at £3 15*s.* per ton, straw £2, mangolds 10*s.*, turnips 8*s.*, swedes 8*s.*, cabbages 8*s.*, pea haulm £3, oats £10 10*s.*, green vetch, maize, etc., 5*s.* per load, and meadow land (charged to summer period only) 28*s.* to 40*s.* according to quality and situation. On the average of all herds, in the winter period (November-April), the cost of food was 5·97*d.* per gal., in the summer period (May-October), 3·24*d.* per gal., and, in the whole year, 4·53*d.* per gal.

The recognised theoretical standard rations gave satisfactory results both as to yield of milk and cost of production; the requirement of a 1,000 lb. cow giving 10 lb. of milk is placed at 1·2 lb. digestible albuminoids, and 8·0 lb. starch equivalent, an additional ·06 lb. digestible albuminoids, and ·25 lb. starch equivalent being fed for each additional lb. of milk.

Rations of Dairy Cows and Age of Calving as Factors Influencing Growth and Dairy Qualities (*Univ. of Missouri Agric. Expt. Sta. Bull. No.* 135).—The investigation lasted over eight years, and related to 40 animals of which complete records were kept from birth to maturity. The general conclusion drawn is that it is possible to influence the rate of growth, size when mature, and type to some extent, by the liberality of the ration during the growing period and the age at first calving.

Compared with light feeding, heavy rations during growth produced a much more rapid growth of "skeleton," and larger, coarser and much fatter animals in the end; the animals matured sexually at from two to four months earlier; the feeding seemed to have little or no effect on milking functions when mature.

Compared with late calving, early calving checked growth, giving a smaller and more refined type of cow; the highest milk production was obtained from cows well matured before the beginning of lactation.

The Poisonous Properties of Cacao Shells (*Deut. Landw. Presse*, 9th June, 1915).—It appears that poisoning of horses may follow the feeding of large quantities of cacao shells. In a Danish case the rations of horses contained 2½ lb. of the shells on several occasions; one animal died after a short illness from paralysis of the heart, the symptoms being sweating, exhaustion, unsteady gait and yawning. In a German case several horses fell ill after being fed on the shells from a chocolate factory, and one died. Poisonous effects from the shells were obtained experimentally with rabbits, guinea pigs, and human beings.

The poisonous properties are due to the alkaloid *Theobromin*, the shells containing up to 1·11 per cent., but on the average 0·76 per cent., of this substance, according to König, and some investigators maintain that the roasting process increases the content of this alkaloid. If 2½ lb. of the shells are fed at a meal it would be possible for the system to contain ⅛ lb. of *Theobromin* after 4 days. No experiments with *Theobromin* on horses are on record, but half this quantity of the related *Caffein* has killed horses and cattle and one-twentieth pigs and goats.

Cacao Cake (89 *de Beretning fra Forsogslaboratoriet* [Denmark] 1915.) Cacao cake, a by-product from the manufacture of cocoa, has been imported into Denmark. These experiments were carried out in 1911, 1912 and 1913 with two lots of 10 cows each; 3 lb. of cacao cake in 1911 replaced 2 lb. of a mixture of ground nut and soya bean cakes in the ration. The milk yield was reduced by 2·64 lb. per cow per day in consequence, the experimental period being 56 days; the fat percentage was increased from 3·26 per cent. to 3·51 per cent., but this was not sufficient to compensate for the decreased yield.

In 1912, 1·54 lb. of cacao cake was *added* to the cake and roots ration of 10 cows for 67 days, the control cows' ration being unchanged. The cacao cake addition reduced the milk yield by 1·2 lb. per cow per day and increased the average fat percentage over the period from 3·27 to 3·42 per cent., an amount insufficient to compensate for the decreased yield.

The 1913 experiments were carried out on similar lines to those in 1912 (the addition of cacao cake was raised to 2 lb. per cow per day) and with similar results.

In addition to the detrimental effect on milk secretion shown by the above experiments, veterinary investigations in 1912 and 1913 showed the cake to be poisonous. It is, therefore, not recommended for milk cows.

Bracken Roots and Fronds for Pig Feeding.—A note in the *Wiener Landw. Ztg.* of 22nd April, 1916, directs attention to a recommendation of the Prussian Ministry of Agriculture as to the value of bracken roots (rhizome) as a substitute for potatoes for pigs. The recommendation is based on investigations by Drs. Hansen and Mez of the Agricultural and Botanical Institute at Königsberg. Sucking pigs and young pigs of 55–66 lb. after being accustomed to the food were fed 2¾ lb. per head per day without harmful results; tests with fattening pigs were not then concluded. The roots may be gathered until the end of April, after which their feeding value diminishes; one man can be put to work turning over the ground, while a child picks out the roots which are then washed and fed without being chopped or otherwise prepared.

In a communication, in the *Deutscher Reichsanzeiger* of 16th May, 1916, from the Prussian Ministry of Agriculture, a report on feeding experiments with the young fronds is quoted, in which they were found to be a good supplementary food for pigs. It is recommended to steam a mixture of the fronds with a few potatoes and a little water and then cut them up small. It is stated that only such fronds can be used as are rolled up and not yet unfolded and which easily break off smooth, *i.e.*, at a height of 16 in. to 20 in. Older fronds are not suited to pig feeding.

Dried Chicory Roots as Horse Feed (*Commerce Reports* [U.S.A.], No. 156, 1915).—The Technical Association for Chicory and Beet Drying in Magdeburg reports that dried chicory roots ("chicory crumbs") make an excellent substitute for oats. Analysis shows them to contain

moisture, 13·79 per cent.; protein, 4·85 per cent.; fat, 0·85 per cent.; carbohydrates and ash, 69·73 per cent, (of which sugar, 4·35 per cent.).

It has been claimed for chicory that it acts as a digestive, and recent experiments with the "crumbs" have borne out this claim, no digestive troubles having been noticed where the chicory was used, and cases of indigestion brought on by the excessive use of sugar feed in Germany having been at once relieved by the use of chicory crumbs.

The chicory roots are fed dry to horses in quantities up to 10 lb. daily per horse, and are much relished. They are neither moistened nor ground, but no practical grinding machine has been found. If the crumbs could be ground, an ideal fodder could be made by mixing the ground crumbs with sugar or molasses.

Norwegian Fish Meal (*Fühling's Landw. Ztg.*, 15th January, 1916).—In this paper Norwegian fish-meal products are classified into (*a*) cod, (*b*) herring, (*c*) whale.

Cod meal is made from the dried and ground heads and bones of this fish, caught on the central and northern coasts of the country during the winter months. Its composition is fairly constant and averages: crude protein 52·5 per cent., crude fat 2·0 per cent., ash 31·3 per cent. (of which 26·9 per cent. phosphate of lime). The digestibility (pepsin test) of the crude protein is 89·7 per cent., though actual experiments with animals have given a somewhat lower figure. The cod meal has a bright yellow grey colour and has a strong fishy smell. The product is used almost solely as a feeding-stuff and for pigs, and to add to a ration rich in carbohydrates or poor in protein or ash (*e.g.*, potatoes, maize, etc.).

Cod-liver meal is prepared from the residues after extraction, by steam, of the cod-liver oil. The meal is fairly fine, of a yellow grey colour, and contains a large amount of oil owing to the difficulty of fully extracting the latter; on the average the meal contains: crude protein 52·6 per cent., crude fat 30·0 per cent., ash 4 per cent. In spite of its high content of oil it is used in small quantities for feeding to dairy cattle. Recent experiments at the Norwegian Agricultural High School have shown that dairy cows can be fed for long periods with 3 lb. cod-liver meal per head per day with good results and without any digestive troubles; the feeding, however, caused a notable drop in the fat content of the milk and the butter had a soft, tallowy consistency although its keeping qualities were not affected. No taste of fish or oil could be detected in the milk or butter although the milk had at times a foreign fat-like taste; 8 lb. of cod-liver meal were found to be equal to 10 lb. of decorticated cotton-seed meal. The following digestibility coefficients were obtained with a goat: dry matter 90·8, crude protein 94·2, crude fat 96·9.

Herring meal from whole herrings is prepared from small herrings and other herrings which for some reason cannot be sold as human food and which are, therefore, used for the production of oil and feeding-stuff. This feeding-stuff is characterised by a high protein content and a low salt content. It has a strong, but not unpleasant, herring smell. Its average composition is; crude protein 67·0 per cent., crude fat 11·2 per cent., ash 13·0 per cent. (9·8 per cent. phosphate of lime). Digestibility of crude protein (pepsin test) 92·2 per cent.

Herring meal from rather salt fish residues is prepared from heads, etc., of pickled herrings and residues of preserve factories (the Norwegian "sardines"). This meal has a brighter and yellower colour than that

mentioned above. Prices of bone, roe; and leaves, etc., are often present and the composition varies greatly, the following being an average: crude protein 53·7 per cent., crude fat 10·0 per cent., ash 23·6 per cent. (9-10 per cent. salt, and 10·9 per cent. phosphate of lime). Digestibility of crude protein (pepsin test) 86·5 per cent. A test with goats gave the following digestibility coefficients: dry matter 86·0, crude protein 86·5, crude fat 98·2, ash 33·2.

Both kinds of herring meal have been used in Norway for many years as a protein-rich concentrated feeding stuff for dairy cows to a large extent,

Whale meat meal (prepared from meat after extraction of oil) is brown, dark, and powdery. The content of oil varies greatly, rendering average figures hard to obtain, but the following is the average of 23 tests: crude protein 62·3 per cent., crude fat 25·1 per cent., ash 4·8 per cent. Digestibility of crude protein (pepsin test) 72·5 per cent.

Whale guano is prepared from spoilt material ground together with the bones: it has the same appearance as the above, but white particles of bone are often visible. It contains on the average 7·5 per cent. of nitrogen and 10·5 per cent. of phosphoric acid, with a high fat percentage.

Whale bone meal contains about 4 per cent. of nitrogen and 22 per cent. of phosphoric acid.

Whale feeding meal contains more bone than the meat meal. Its average composition is: crude protein 50·0 per cent., crude fat 13·7 per cent., ash 28·0 per cent. (21·8 per cent. phosphate of lime).

Both whale meat meal and feeding meal are much in demand in Norway for feeding to dairy cows.

Lamb-Breeding Tests (*Jour. Dept. of Agric., Victoria*, March, 1916).—Lincoln merino first cross 4-tooth ewes were mated with rams of the Lincoln, Border Leicester, English Leicester, Dorset Horn, Shropshire and Southdown breeds in 1913 and 1914. In 1915, first cross 2-tooth ewes were used and the Suffolk was substituted for the English Leicester. The ewes were divided into six sections of 50 in 1913 and 40 in 1914-15. Mating commenced in the third week of January, and lasted for seven weeks. The results of lambing were:—

Breed.	1913.*		1914.†		1915.†	
	No. of Live Lambs.	No. of Dead Lambs.	No. of Live Lambs.	No. of Dead Lambs.	No. of Live Lambs.	No. of Dead Lambs.
Lincoln	51	11	32	1	38	10
Border Leicester ..	42	5	36	1	35	2
English " ..	41	11	40	2	—	—
Dorset Horn	43	6	40	3	34	3
Shropshire	41	11	36	1	33	3
Southdown	48	1	33	1	36	5
Suffolk	—	—	—	—	27	7

* 50 ewes with each ram. † 40 ewes with each ram.

The wether lambs were sold for slaughter at about the age of seventeen weeks, and three weeks later the ewe lambs were shorn.

The average prices realised by the wether and the average values of the wool obtained from the ewe lambs were as follows :—

Breed.	Average Prices per Wether Lamb.			Average Value of Wool per Ewe Lamb.	
	1913.	1914.	1915.	1913–14.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.
Lincoln	15 0	14 0	24 3	2 5½	—
Border Leicester ..	13 9	16 2	25 10	1 8¾	2 7½
English ,, ..	13 1	14 1	—	2 1½	—
Dorset Horn	13 6	14 11	23 0	1 10	2 1¾
Shropshire	12 10	13 10	25 0	1 6	2 6½
Southdown	11 6	14 0	23 2	1 7¼	1 5¼
Suffolk	—	—	26 0	—	2 8½

The Vitality of Seeds Excreted by Cattle (*Agric. Jour. of India*, October, 1915).—Cattle were given whole wheat grains with their fodder. The dung of the animals was collected, and the undigested wheat grains were germinated. It was found that from 9·6 per cent. to 20·5 per cent. of the grain eaten by the animals was passed by them in a condition to give strong, healthy plants. Gram grains were later substituted for wheat grains, but, although large numbers of apparently undigested gram grains appeared in the dung, practically none of these germinated.

Yellow Coloration of Cream and Butter (*Missouri Univ., Agric. Expt. Sta., Circ.* 74).—The yellow colour of cream and butter was found to be primarily due to the pigment known as carotin, which is present to a greater or less degree in most foods. When foods rich in carotin, such as fresh pasture grass, green hay, soiling crops and carrots or other yellow roots were fed, the yellow colour in the cream and butter was much more pronounced than when the cows received foods lacking in carotin, such as dry hay, maize silage (except when very fresh), straw, maize, wheat offals and other by-products such as cotton seed meal, brewers' grains, linseed meal, etc. The investigations also led to the conclusion that Jersey and Guernsey cows were able to utilise the carotin in their food to a greater extent than were Ayrshires, Holsteins and other breeds and, moreover, possessed the ability of storing the pigment in their blood, skin and fat and thus of producing yellow cream for a considerable time when fed on rations lacking in carotin.

WEEDS AND PLANT PESTS.

A Disease of Lavender (*Kew Bulletin*, No. 5, 1916).—This paper deals with a disease which is not uncommon in lavender and which at times is the cause of serious loss. The disease at first affects individual shoots only, but finally the complete plant becomes involved and, in a bed, the disease rapidly spreads until all the plants are in a weak or dying condition.

In the case which came under notice two large beds were diseased, practically every plant dying. Affected shoots presented a dry, dirty brownish-grey colour, and the epidermis tended to split away in minute silvery flakes. The leaves on a diseased stem preserved their normal

appearance for some time, and then somewhat rapidly wilted and became brown and shrivelled. All portions of the plant above the dry discoloured areas died.

The disease was found to be due to a fungus identified as *Phoma lavandulæ*. As regards its life-history, the overwintering of the fungus and the spring infection of the host take place by means of the occasional chlamydospores, and pycnospores remaining in pycnidia, present in decaying fragments of old diseased shoots; the rapid spread of the disease during the summer months is due to the pycnospores which are produced in immense numbers. The optimum temperature for the growth of the mycelium was found to be about 18°-20° C. Infection experiments demonstrated the pathogenicity of the fungus to the genus *Lavandula* and showed that the fungus was probably confined to this genus.

The disease may be kept in check by the removal of all affected shoots as soon as noted, and, if possible, before pycnidia are formed.

Fungicidal Properties of Certain Spray Fluids (*Jour. Agric. Sci., April*, 1916).—Solutions of such substances as "liver-of-sulphur" and ammonium sulphide when used against the "powdery mildews" in the actively-growing conidial stage require the addition of some substance such as soft soap in order to increase their wetting properties and so secure complete fungicidal action.

It is only when the concentration of "liver-of-sulphur" solutions reaches 0·6 per cent. or 0·8 per cent. that this substance begins to be fungicidal against the growing mycelium of "powdery mildews."

A solution of yellow ammonium sulphide proved to be completely efficacious against hop-mildew (in the greenhouse) and American gooseberry-mildew (in the open); the material left no visible deposit and did not therefore disfigure the fruit; and solutions of definite fungicidal strength caused no "scorching" injury to the foliage.

Iron sulphide, of concentration 0·6 per cent., had a remarkably quick fungicidal action on hop-mildew. When made by a method which leaves a trace of ammonium sulphide present it proved to be quite harmless to foliage and is in a condition which enables it to be applied as a fine spray.

Wart Disease (*Board of Agric. for Scotland, Fourth Report*).—The varieties of potatoes which have been tested in the past two years and found to be practically immune to the attacks of wart disease are: *Early*—Edzell Blue and Snowdrop (white fleshed). *Second Early*—Abundance, Entente Cordiale, Flour Ball and Great Scot. *Late or Main Crop*—Burnhouse Beauty, Golden Wonder, Irish Queen, Iris, Kerr's Pink, Davie's Laird, Provost, Rector, Schoolmaster, The Admiral, The Lochar, and Templar. It appears to be probable that the powers of resistance to wart disease possessed by a particular variety of potatoes may gradually diminish from year to year, so that continued experiments are necessary.

Treatment with formalin proved quite ineffectual in eradicating wart disease.

Mangold Fly (*Bull. Entom. Research*, May, 1916; Dr. A. E. Cameron).—The following conclusions are considered to have been tentatively established:—

The mangold fly (*Pegomyia hyoscyami*) reared on belladonna will oviposit and complete its life history on mangolds if belladonna be absent. When reared on the leaves of the mangold this fly will more readily oviposit on the leaves of the same plant than on sugar beet.

The dock fly (*P. bicolor*) reared on dock does not oviposit and complete its life-history on the leaves of mangold or sugar-beet. It may also be safely asserted that neither does *P. hyoscyami* reared on mangold or sugar beet leaves oviposit on those of dock.

Germination of Seeds of Clover Dodder (*abs. Zeit. Pflanzenkrank.*, 1916, 3 and 4).—Seeds of clover dodder lose appreciably in germinating capacity after a month in liquid manure or even simply water. Seeds at a depth of 6 to 8 in. in the soil increase in germinating capacity in the first months; after three months the germinating capacity decreases much more quickly than in the case of seeds kept dry. In properly kept farmyard manure nearly all seeds lose their germinating capacity after a month. It can be accepted in practice that well-treated farmyard manure is not a favourable medium for the distribution of clover dodder seeds, though the possibility of infestation being thus brought about is not entirely absent.

True and False Wild Oats (*Canadian Dept. of Agric., Seed Branch, Bull. No. S. 7*).—To determine the status of false wild oats in relation to agriculture, the distinguishing characteristics of true and false wild oats were ascertained. In the growing stage false wild oats can be distinguished by the fact that its manner of growth is characteristic of a cultivated oat. As regards seeds, there seems to be no fixed character by which to distinguish the two forms in the case of some of the smaller varieties, while the seeds of the larger sorts are larger in the case of false wild oats and more closely resemble the cultivated variety. Further, false wild oats does not possess the power of true wild oats of resisting germination for considerable periods; this is an important point because, owing to the tendency of false wild oats to shell out, they drop to the ground before other oats, germinate quickly on after-harvest cultivation, and are killed by frost before they can ripen their seeds.

It is not thought probable that false wild oats will ever become a serious weed pest in Canada, and it is not intended to class it as a "noxious weed" for the purposes of the Canadian Seed Control Act.

Wild Oats (*Trudy Bjuro po prikladnoj Botanikje*, March, 1916).—Wild Oats (*Avena fatua*) is very widespread in the government of Archangel, being met with in practically all the agricultural districts and often causing very heavy losses. Barley especially suffers from the pest, but rye is also seen smothered by the weed owing to the strong infestation of the soil; 2 lb. of wild oats seed was picked up by the author on 27 sq. yd. of soil in a peasant field after the harvest of barley. The spread of the weed has been due to the impurity of the seed sown, the frequent practice of continuous barley cropping, the frequent fallowing with insufficient cultivation of fallows, and the strip system of cultivation.

To combat the weed, an increase in the number of State seed-cleaning stations is recommended, with the travelling of each station from district to district in the winter, and with demonstrations of machinery and cultivation methods, lectures, discussions and experiments. The introduction of grasses into the rotation and the sowing of vetches in fallows are further measures recommended.

Potato Scab (*Jour. Agric. Research* [U.S.A.], May, 1915).—Investigations are described which explain, to some extent at least, why potato scab disease (*Oospora scabies*) is retarded under cool or moist conditions. As regards *germination* of the conidia of the potato-scab organism temperatures of from 35° to 40° C. were found most favourable; while for *growth* 25° to 30° C. were the most favourable temperatures, the maximum for growth being about 40·5° C. and the minimum about 5° C.

Destruction of Charlock (*Rept. on Field Expts. at Harper Adams Agric. Coll.*, 1914).—Kainit and nitrolim were applied in a finely-powdered condition to barley infested with charlock, the former at the rate of 4, 6, and 8 cwt. per acre, and the latter 1¼ cwt. per acre. Both gave good results in suppressing the weed.

The Effect of Smoke on Vegetation (*Iowa Agric. Expt. Sta. Bull.* 145).—The conclusions reached are that gases and smoke have a deleterious action on vegetation; and that the vegetation round a smoke area can be divided into concentric belts, each belt being represented by a certain form or forms of plant life, since certain plants are more susceptible to smoke injury than others. Certain plants are recommended for industrial centres on account of their resistance to smoke.

Use of Warm Water in Eradicating Insects and Fungi (*Jour. d'Agric. Prat.*, 20th May, 1915).—According to a communication made to the French Academy of Agriculture, warm water (at a temperature of 55-65° C.) has been successfully used in destroying insect and fungus parasites on cultivated plants. Those insects and fungi investigated have proved much less resistant than the plants on which they are parasitic. The burning of the teguments or external organs of the parasites has been sufficient to kill them, while, on the other hand, only the surface cells of the plants have been temporarily affected and the plants have been unharmed.

Milling and Baking of Wheat Containing Impurities (*U.S. Dept. of Agric. Bull. No.* 328).—Experiments were made to ascertain the effect of rye, corn cockle, or wild vetch seed in wheat on milling and baking qualities. Different percentages of each impurity were mixed with wheat samples, which were then milled and baking tests were made with the flour. The results showed that more than 2 per cent. of these impurities has a detrimental effect, that of rye being the least pronounced. Corn cockle, besides being poisonous, affects the volume, colour and texture of the loaf, and, if present in amounts of 3 per cent., reduces the water absorption of the flour. Vetch seed reduces the size of the loaf and gives bread a yellowish tinge and a disagreeable odour and flavour characteristic of vetch.

OFFICIAL NOTICES AND CIRCULARS.

THE following Circular Letter, dated 12th August, 1916, has been addressed by the Board to the Secretaries of County War Agricultural Committees:—

Coal for Steam Cultivation.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to say that he is informed that arrangements have been made through the Steam Cultivation Development Association, 28, Victoria Street, Westminster, London, S.W., with the object of securing that coal for steam cultivation shall arrive at the farm in time to avoid delay in the operation of steam cultivation machinery, and I am to suggest if any cases are brought under the notice of your Committee in which farmers experience difficulty in obtaining coal for the above purpose, they should be advised to communicate with the above-mentioned Association in the matter.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

THE attention of farmers is drawn to the opportunity which now presents itself of obtaining sulphate of ammonia at a reduced rate during August and September.

Sulphate of Ammonia.

Reduced Rate for Delivery during August and September.—The Board are informed by the Sulphate of Ammonia Association that sulphate of ammonia (24½ per cent. ammonia) will be offered for sale from now till the end of September at 15*s.* per cwt. net cash, on condition that the quantities purchased at this reduced rate are removed from sellers' works by the 30th September, 1916. Quantities exceeding 15 tons to be taken in equal monthly deliveries during August and September.

Price for 1916-17 *Season.*—After that date, the price for home sales of sulphate of ammonia during 1916-17 season will be 15*s.* 6*d.* per cwt. net cash.

The goods will be delivered free on rail at makers' works in makers' bags, 3*d.* per cwt. being allowed if buyers supply their own bags.

Farmers are strongly recommended to take advantage of the reduced terms offered by the Association, as they will thereby facilitate delivery and also secure supplies which, owing to the increased requirements of the Ministry of Munitions, may not be so easily obtainable next year.

Under favourable weather and soil conditions sulphate of ammonia is a very suitable autumn manure for cereal crops.

Nitrogenous manures are most effective in increasing the yield of cereal crops, and are also of great use for most other crops, especially grasses, potatoes, mangels, turnips, and cabbages. Sulphate of ammonia, which is produced in this country, is now the cheapest and most available form of nitrogen for agricultural purposes. The quantity of sulphate of ammonia used by farmers in the United Kingdom could be doubled with profit to themselves and advantage to the State.

Leaflets dealing with the use of sulphate of ammonia may be obtained free of charge on application to the Secretary, Board of Agriculture and Fisheries, 8, Whitehall Place, London, S.W.

THE Army Council have decided to release some 27,000 soldiers to assist with the harvest. Subject to military necessities of transport, etc., the soldiers will be allotted in accordance with the numbers available for the various districts.

Soldiers for the Harvest.

The terms and conditions of employment will be the same as those now in force.

New applications for soldiers must be made through the local Labour Exchanges on the forms provided for the purpose, and no application will be entertained unless it has been received at the Labour Exchange before 12 noon on Wednesday, the 9th inst.

Applications already made, if they ask for soldiers to be sent on dates between the 14th and 21st August inclusive, will be met, as far as possible, and no new application is necessary. In all other cases new application must be made.

It will be recognised that the number of soldiers that will be released represents only a small fraction of the number of men normally employed in the harvest, and that many of the soldiers will be unskilled in agricultural work. It is also necessary for military reasons to retain in

the Eastern counties a large proportion of the men released for harvest work.

Although farmers are required to state in their applications the date on which they desire soldiers to be sent to them, they must be prepared to receive the soldiers applied for within a day or two either before or after the date stated.

Agricultural Returns for Scotland, 1916.

THE Board of Agriculture for Scotland have prepared provisional estimates of the acreage of wheat, barley, oats, potatoes and hay, and the numbers of each class of live stock in Scotland, based on a proportion of the returns made on 5th June last. The figures are given in the following table, with a comparison with those for 1915. It will be observed that barley and oats show increases of 23,000 and 3,000 acres respectively while wheat shows a decrease of 13,000: the total area under these three crops is thus larger by 13,000 acres. The area under potatoes is less by 15,000 acres, while that under rotation grasses and clover for hay is greater by 28,000. Cattle, as a whole, have slightly increased in number, but sheep and pigs are fewer.

The usual Preliminary Statement of the Agricultural Returns will be issued when the tabulation has been completed.

Crop.	Acreage.	Increase (+) or Decrease (–) as compared with 1915.	
		Actual.	Per cent.
Wheat	64,000	–13,000	–16·88
Barley	172,000	+23,000	+15·44
Oats	986,000	+ 3,000	+ 0·31
Potatoes	129,000	–15,000	–10·42
Rye-grass, etc., for hay	418,000	+28,000	+ 7·18
Permanent grass for hay	161,000	+ 7,000	+ 4·55
Class of Stock.	**Number.**		
Cows in milk	354,000	– 7,000	– 1·94
„ calf	40,000	– 3,000	– 6·98
Heifers in calf	46,000	+ 1,000	+ 2·22
Other cattle: 2 years and above ..	239,000	+ 9,000	+ 3·91
„ 1–2 years	298,000	+ 4,000	+ 1·36
„ under 1 year	249,000	– 2,000	– 0·80
Total of cattle	1,226,000	+ 2,000	+ 0·16
Ewes for breeding	3,005,000	0	0·00
Other sheep: over 1 year	1,246,000	+27,000	+ 2·21
„ under 1 „	2,788,000	–63,000	– 2·21
Total of sheep	7,039,000	–36,000	–0·51
Sows for breeding	16,000	– 2,000	–11·11
Other pigs	131,000	–10,000	– 7·09
Total of pigs	147,000	–12,000	– 7·55

Supply of Petrol for Agricultural Purposes.

THE Board have been in communication with the Petrol Control Committee on the subject of the supply of petrol for agricultural purposes. The Board are informed that in consequence of the greatly increased demand for petrol by the Army and Navy, and for other essential services connected with the War, it became imperative to put in force without delay drastic restrictions on its use for all other purposes.

The Petrol Control Committee state that they have endeavoured to the best of their ability in the short time available to classify the various civilian purposes for which petrol is required and to apportion to each class the maximum quantity available. They recognise that it has been impossible to discriminate closely between every individual user, but the whole of the available supply for the three months from 1st August has now been allotted, and consequently it is impossible at present to vary the apportionment. Farmers requiring petrol for their farm machinery have been treated as favourably as any other industrial users, and far more favourably than the owners of private cars.

In view of these circumstances, the Board cannot hold out any hope at present of any increase in the quantity allowed on the licences, but they will endeavour in consultation with the Petrol Control Committee to see that the essential requirements for all purposes connected with agriculture are fully considered whenever the licences have to be renewed.

Appeals *re* Military Service: Postponement of Agricultural Cases until after Harvest.

THE following Circular Letter, dated 26th July, 1916, has been addressed by the Board to their Representatives before the Appeal Tribunals:—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to advert to the Board's Circular Letter of the 10th July with reference to the postponement of the hearing of agricultural cases until after the harvest, and I am to forward to you for your information the enclosed copy of a Circular Letter which has been addressed by the Local Government Board to the Appeal Tribunals.—I am, etc.,

SYDNEY OLIVIER, *Secretary*.

ENCLOSURE: *Copy Letter of 25th July*, 1916, *addressed by Local Government Board to the Appeal Tribunals.*

SIR,—I am directed by the President of the Local Government Board to state that he has been informed that an arrangement has been made between the Board of Agriculture and the War Office to the effect that if the Agricultural and Military Representatives to an Appeal Tribunal agree, request may be made to the Appeal Tribunal to postpone the hearing of agricultural cases until after harvest, it being considered that it would be undesirable, in the national interest, to take farmers and their employés away from their work during the busy time of harvest.

Mr. Long considers that, if such an application is made to the Appeal Tribunal, with the concurrence of the Military Representative, the Appeal Tribunal will be justified in adjourning cases accordingly.

It is desirable, of course, that all cases so adjourned should be dealt with as soon as possible after harvest is over.—I am, etc.,

I. G. GIBBON, *for Assistant Secretary.*

Parliamentary Questions and Replies on Agricultural Matters.

THE following questions relating to matters of importance to agriculturists have recently been asked in the House of Commons, and as the replies given to them are of general interest to farmers they are printed here for their information:—

British Farming (Danish Labourers).—Mr. King (21st June) asked the Parliamentary Secretary to the Board of Agriculture what wages it is proposed to pay to the Danish labourers who are being brought over for a year to assist British farmers; and whether in the event of the War ending within a year, any curtailment of this hiring for a year is contemplated?

Mr. Harcourt: My hon. Friend has asked me to reply to this question. The employer when applying for the services of these workmen states the rate of wages offered, which is required to be not less than the current rate for the occupation and district. The period for which the workmen agree to remain in this country is twelve months or the duration of the War, whichever period is shorter, so that the hiring would be automatically terminated if the War ended within the year. I should add that in compliance with the expressed wish of the Danish Government it has been possible to recruit only a very limited number of men in Denmark, and the Board cannot entertain any further applications for these workmen.

Calves killed.—Mr. Stuart-Wortley (12th July) asked the Parliamentary Secretary to the Board of Agriculture whether he can give the number of calves killed in the United Kingdom or in Great Britain in 1914, 1915, and (up to the latest date for which Returns are available) in 1916?

Mr. Acland: I regret that Returns of the total numbers of calves killed annually in this country are not available.

Maintenance of Live Stock Orders.—Captain Douglas Hall (20th July) asked the Parliamentary Secretary to the Board of Agriculture if it is the intention of the Board of Agriculture to reconsider the recent Maintenance of Live Stock Orders, 1916, next month as regards calves?

Mr. Acland: Yes, Sir. The matter will receive special attention as soon as a preliminary tabulation and summary can be made of the Returns of live stock which were made last month. I hope this will be before the end of this month.

Vacant Land.—Mr. Wing (20th July) asked the Parliamentary Secretary to the Board of Agriculture if there are 14,000 acres of vacant uncultivated land in and around London: is he aware that the Vacant Land Cultivation Society is prepared to secure its cultivation if assisted to possession by tenure of long or short leases by the Government; and whether, seeing the good work in the same direction already accomplished by this Society, he will put himself into communication with that body with a view to the productive use of land now derelict?

Mr. Acland: The Department have no particulars of the acreage of vacant land in and around London. The last Report of the Vacant Land Cultivation Society shows that in 1915-16 it was able to deal with the cultivation of 37 acres, and in order to assist them to extend their work a grant of £100 from the Development Fund has been made to them on the recommendation of the Board. The Government is not in a position to assist the Society to possession in the manner suggested, but my Department will be glad to continue in communication with them and further help them by any means in their power.

Sugar Supply (Jam Making).—Major-Gen. Ivor Philipps (24th July) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware that quantities of strawberries and other fruit are rotting in gardens in the country owing to the impossibility of procuring sugar for preserving them; and if he will say what steps he is taking or has taken to meet this difficulty and to prevent this waste of valuable food?

Mr. Acland: The information of the Board does not support the statement made in the first part of the question. The Royal Commission on Sugar Supplies have made arrangements which enable commercial jam makers to obtain 75 per cent. of their last year's supplies now and the remainder later on. Private fruit growers will, it is hoped, also be able to obtain sufficient supplies of preserving material.

Wool Purchase, 1916.

THE following is a copy of "Instructions to Farmers" issued by the War Office in July, 1916, with regard to the purchase of wool by the latter:—

A—District Executive Officer.—Great Britain will be divided into Wool Areas in each of which there will be a district executive officer of the War Department who will be an expert wool buyer and will superintend all wool purchases on behalf of the Government. He will have a local advisory committee consisting of representatives of interests concerned. Authorised buyers will be selected from amongst those merchants who usually operate in the district.

B—Census of 1916 Clip.—You are required to make a return, in duplicate, of your fleeces, and either to give the name of last year's buyer and the firm he represents or to state if sold by auction. You should receive from the police a census form on which to make your return. If no form is received, you should apply for one to the police officer of your district.

The information asked for in the return is required in order that steps may be taken to buy your wool.

Any delay in making the return will delay the purchase of your wool.

C—Purchase.—(1) The merchant who purchased your wool last year will, if he is an authorised buyer value your wool and accept delivery this year.

(2) You will be advised by the authorised buyer, when and where he is going to value your wool.

(3) The authorised buyer will value the wool in accordance with a scale of wool prices fixed by the Government.

(4) The authorised buyer will, after inspection and weighing of the wool, estimate its value. 75 per cent. of the estimated value will be paid by the Government within about six days of delivery, and the balance will be paid when the final valuation has been made (*i.e.*, after the final inspection of the fleeces in the merchant's warehouse).

(5) If you have less than 50 fleeces for sale, your wool will be purchased outright and paid for by the authorised buyer.

D—Packing.—(1) The authorised buyer will give instructions with regard to the packing.

(2) If your wool is already packed, you should attach a label to each sheet indicating the owner of the sheet.

E—Delivery.—You will deliver your wool as usual:—

Either (*a*) to the authorised buyers' warehouse,
or (*b*) to the nearest railway station,
or (*c*) to some convenient centre indicated to you.

F—Weighing.—Wool will be weighed in the usual places and according to the usual customs of the trade. You will therefore be able to see your wool weighed, if you wish to do so.

G—Interest.—Provision will be made for the prompt taking up of your wool by the authorised buyer, but, if your wool is not bought before 1st August, the Government will pay interest at the rate of 5 per cent., per annum on all valuations as from 1st August until the date of payment, if you have complied with the instructions given to you.

H—Storage.—If your storage accommodation is such as to render the wool liable to damage if not removed at an early date, you will write pointing this out to the district executive officer whose address is given on the back of your Census Form. You may also make temporary arrangements to store the wool at your own expense, preferably on the premises of the merchant to whom you sold last year.

Prohibition of the Lifting of Hay and Straw in England, Wales and Ireland.

IN pursuance of the powers conferred on them by the Defence of the Realm (Consolidation) Regulations, 1914-16, the Army Council have ordered that all hay or oat or wheat straw of the 1916 crop in England, Wales and Ireland, now standing in bulk or as and when harvested is taken possession of by the Army Council, and shall from the date of the Order, namely, 30th June, or as and when harvested, be held at the disposal of the duly authorised officers of the War Department.

This Order is without prejudice to the Order of the Army Council of 31st March, 1916, relating to the prohibition of the lifting of hay and straw in Great Britain which still remains in force as regards Great Britain in respect of all hay or oat or wheat straw other than the 1916 crop.

Detailed instructions regarding the necessary procedure to be adopted by all desiring to sell, purchase or remove hay or straw under this Order may be obtained on application to the Secretary, Forage Committee, 64, Whitehall Court, London, S.W., or in Ireland to the Area Administrative Officer, Royal Hospital, Dublin.

Swine Fever Order of 1916.

IN exercise of the powers vested in them under the Diseases of Animals Acts, 1894 to 1914, and of every other power enabling them in this behalf, the Board of Agriculture and Fisheries have made an Order (*The Swine Fever Order of* 1916, dated 26th June, 1916, that (1) a Notice served by an Inspector of the Board of Agriculture and Fisheries under Article 4 of the Swine Fever Order of 1908 may modify the Rules which under Article 5 of that Order would otherwise apply to the premises affected by the Notice, provided that the Rules as so modified are printed as an indorsement on the Notice; and (2) a Licence issued by an inspector of the Board, authorising movement of swine into a Swine Fever Infected Place or into premises into which movement of swine is, by reason of a Notice under the said Order, subject to the Rules contained in Article 5 of that Order, may contain such conditions as to the movement of the swine, or as to the treatment of the swine after their arrival at the premises, as the inspector thinks fit, and if any such condition is not complied with the owner of the swine and the occupier of the premises shall each according to and in respect of his own acts and defaults, be deemed guilty of an offence against the Diseases of Animals Act, 1894.

Harvest Weather Forecasts.

THE Meteorological Office will, as in past years, but subject to certain restrictions, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1*s*. and the cost of the telegrams, computed at 9*d*. per day. The supply of forecasts will continue until 30th September. The forecasts are drawn up each week-day at 3.30 p.m., and refer to the probable weather during the 15 hours from 6.0 a.m. to 9 p.m. on the next day. The addition of a "further outlook" and the issue of notifications in connection with spells of settled weather are suspended during the war.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W., with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period, which should not be less than 6 consecutive days, during which the forecasts are to be sent.

Spraying of Potatoes.

THE following Notice was issued to the Press on 24th July, 1916:—The Board of Agriculture and Fisheries desire to impress on potato growers the importance of spraying their crops with a suitable fungicide (Bordeaux or Burgundy mixture) as soon as possible. The recent rains are likely to lead to an outbreak of potato disease, which may seriously injure the crop, and should the weather continue to prove unseasonable the loss may be considerable.

A Leaflet (No. 23) on spraying for potato disease can be obtained on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W., gratis and post free. Letters so addressed do not need to be stamped.

Produce of Crops in England and Wales in 1915.

PART II. of the Agricultural Statistics for 1915, containing returns of produce of crops in England and Wales in 1915, with summaries for the United Kingdom, has been published [Cd. 8300, price 2*d*.].

Ensilage.

THE Board of Agriculture and Fisheries desire to remind farmers that ensilage offers a useful method of preserving fodder when wet weather prevents the saving of hay in good condition.

The best silage is made in a specially constructed silo, but very good silage can also also be made at relatively small cost in stacks and clamps.

Particulars for making silage will be found in the Board's Leaflet No. 9 (*Ensilage*), and details as to its use as food for stock, in articles in the Board's *Journal* for March and June, 1916. A paper on the cost of producing silage in Norfolk and Suffolk appeared in the *Journal* for July.

Warning against the Use of Benzoate of Soda for Jam-making.

THE following Notice was issued by the Board on 10th August, 1916:—Communications have reached the Board of Agriculture and Fisheries referring to a statement which has appeared in the public press to the effect that benzoate of soda may be used to replace sugar in the preparation of jam.

The Board are advised that benzoate of soda is quite unsuitable for the purpose in question, and desire to warn the public against its use in jam-making. Serious results might follow an attempt to substitute this material for sugar.

SINCE the date of the list given on p. 193 of the *Journal* for May, 1916, the following Leaflets in the ordinary series have been revised and brought up to date:—

Leaflets in 1916.

No. 29.—*Swine Fever.* This Leaflet has been entirely re-written.

No. 30.—*Codling Moth.*

No. 94.—*Millepedes and Centipedes.*

No. 100.—*The Breeding and Management of Pigs.* This Leaflet has been entirely re-written.

No. 102.—*Blackquarter, Quarter Ill, or Black Leg.* This Leaflet has been re-written.

No. 114.—*Feeding of Poultry.*

No. 122.—*Cabbage Root Fly.*

No. 129.—*Winter Egg Production.*

No. 288.—*The Cultivation and Collection of Medicinal Plants in England.*

A Memorandum on *Farmers and the Income Tax*, compiled under the authority of the Board of Inland Revenue, has also been issued in leaflet form.

The following Special Leaflets have been issued since the date of the last list:—

Special Leaflet No. 62.—*Co-operative Farm Implement Societies.*
" " No. 63.—*Carriage of Fruit and Empties.*

A Welsh translation of Special Leaflet No. 55 (*How to Increase the Production of Food during the War*) has also been issued.

The following Special Leaflets have been revised and brought up to date:—

Special Leaflet No. 3.—*Poultry in Allotments and Garden Plots.*
" " No. 5.—*Fruit Preserving for Small Market Growers or for Domestic Use.*
" " No. 28.—*Suggestions for the Cultivation of Catch Crops and Home Grown Feeding Stuffs.*
" " No. 31.—*The Making of Fruit Pulp.*
" " No. 61.—*Transport of Agricultural Requisites and Produce.*

MISCELLANEOUS NOTES.

Plant Export Certificates.—The Board of Agriculture and Fisheries desire to give notice to nurserymen and other persons concerned that it has been found necessary to revise the scale of fees charged in connection with the issue of certificates required to accompany exported plants, etc.

Import Regulations.

1. *Certificates for Plants Exported to the U.S.A.*—The American Government now require that all "nursery stock" (an expression which for this purpose includes orchids) shipped from this country to the United States shall be accompanied by a certificate from a duly authorised officer of the Board that the plants have been examined and found to be free from injurious plant diseases and insect pests. Nursery stock shipped between the 31st May and the 1st October must be examined at the time of packing, but the stock shipped during the remainder of the year must be examined on or after the 1st October, after which no further examination is necessary till the 1st June following.

Growers who desire to export to the United States should advise the Board as early as possible in the year, so that arrangements may be made for a preliminary inspection of their premises during the summer months. A final examination will be made as early as possible in October, and if the nursery is free from injurious diseases and pests the Board will be prepared to issue any certificates required up to the end of the following May on payment of the fees indicated below.

Fees.—The usual charge will be £2 2*s.* 0*d.* in respect of each nursery. A larger sum will be charged in certain cases, and the Board will be prepared to consider applications for a reduced fee when two or more nurseries in the same occupation can conveniently be examined in conjunction. A further charge of 5*s.* per 100 will be made for the certificates issued during the period October to May.

Stock shipped between the 31st May and the 1st October will be examined under the conditions explained in Section 3 of this Memorandum.

2. *Phylloxera Certificates.*—These certificates cannot be issued by the Board unless the premises where the plants were grown have been examined by one of their inspectors. The necessary examination will be made on payment of a fee of £2 2*s.* 0*d.* A separate fee is not charged, however, if the nursery has been inspected in accordance with the arrangement outlined in Section I. A charge of 5*s.* per 100 will be made for certificates issued.

3. *Certificates for Plants to be sent by Parcel Post and for Consignments under 112 lb. in weight.*—When a certificate is required that the plants or bulbs in a consignment have been examined and declared to be healthy or to be free from specified pests, the exporter should make application to the Board a few days before the consignment is to be difpatched. As regards plants or bulbs to be sent abroad through the Parcel Post, a fee of 1*s.*, payable in advance, is charged and the following procedure must be followed :—The plants must be sent to the office of the Board in a box which can easily be opened, and the plants must be packed in such a way that they can be taken out and thoroughly examined and then repacked by the Inspector. The box must be labelled "Plants (or bulbs) for export." A prepaid adhesive label addressed to the consignee must be enclosed, together with the Customs declaration required by the Postal Regulations. After examination the parcel will be posted and a receipt of posting obtained and sent to the consignor. If it be desired that the parcel shall be insured the requisite sum must be forwarded.

Note.—As several countries now refuse to admit plants by Parcel Post, growers should consult the information given in the Post Office Guide as to the regulations of the country of destination before sending plants for examination.

Consignments of plants weighing under 1 cwt. will also be examined at the Board's office. The fees charged for the issue of certificates in such cases are as follows :—

	s.	*d.*
Packages not exceeding 56 lb. in weight	2	6
,, between 56 lb. and 1 cwt. in weight	5	0

Consignments exceeding 1 cwt. cannot be examined at the Board's office, and the fees in such cases will be at a special rate. If, however, it is necessary for an inspector to travel more than 20 miles to the place of examination the fee will be £2 2*s.* 0*d.*

The fee must be paid before the certificate can be issued.

Every care is taken to ensure that plants examined at the Board's offices are properly repacked and promptly dispatched, but it must be distinctly understood that the Board cannot accept any liability in respect of any consignment examined or certificate issued by them.

Importation of Live Stock into New Zealand.—The importation of animals from the United Kingdom into the Dominion of New Zealand is now subject to the following regulations :—

Livestock must be shipped at London, Liverpool, or Glasgow; and the inspection of the animals at the port of shipment is entrusted to the Veterinary Officer attached to the Office of the High Commissioner in London, or to a veterinary surgeon nominated by the High Commissioner, to whom must be delivered :—

(1) A statutory declaration by the shipper indicating (*a*) the kind, number, sex, and brands or marks of the animals; (*b*) as regards horses, asses, and mules: the districts where they have been located during the twelve months immediately preceding the date of shipment; and as regards cattle, sheep, goats, and swine: that they have been in this country during the preceding six months, or from birth; (*c*) that the animals are at the time of shipment, and have been during the preceding six months, free from all infectious and contagious diseases; and (*d*) that, during the six months immediately preceding shipment, they have not been in direct or indirect contact with any infected stock.

(2) A certificate signed by a veterinary surgeon practising in the district in which the animals have been located during the six months preceding shipment, or from which they are moved for shipment—or, in the case of cattle, a veterinary surgeon appointed by the New Zealand Government—testifying that, within a limited period preceding shipment (*viz.*, 30 days in the case of horses, asses, mules, and cattle; and 14 days in the case of sheep, goats, and swine) the animals have been examined and found free from all infectious and contagious diseases; that horses, asses, and mules have been tested with mallein, and cattle with tuberculin; and that, under the supervision of the veterinary surgeon concerned, sheep and goats have been dipped by thorough immersion in an approved scab-destroying preparation.

Dogs may be imported, under analogous regulations, provided that they have been in the United Kingdom from birth or during the nine months preceding shipment.

In the case of animals for zoological purposes, etc., a permit must also be obtained from the New Zealand Authorities.

Animals are quarantined on arrival for the following periods:— Horses, asses, and mules, 14 days, but they may be exempted if they pass the mallein test on arrival; cattle, 40 days; sheep and goats, 28 days; pigs, 14 days; and dogs, 60 days.

The restrictions which the New Zealand Authorities now impose on the importation of cattle, sheep, goats, and swine from the United Kingdom on the occurrence of foot-and-mouth disease in this country, were published in this *Journal* in December last (vol. xxii., p. 906).

Copies of the forms required by exporters should be obtained from the Office of the High Commissioner for the Dominion of New Zealand, 13, Victoria Street, London, S.W.

The exportation of horses, asses, and mules from the United Kingdom is at present prohibited by Order-in-Council, but applications for licences to export may be made to the Secretary, War Trade Department, 4, Central Buildings, Westminster, S.W. No licence is required in respect of cattle, sheep, goats, and swine exported to New Zealand.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for July, 1916, issued by the International Institute of Agriculture, contains the following estimates of the production of cereal crops in 1916 in the Northern Hemisphere: *Wheat* — Spain 19,110,000 qr. against 17,407,000 qr. in 1915; Italy 23,877,000 qr. against 21,312,000 qr.; Switzerland 538,000 qr. against 495,000 qr.; United States, winter 61,109,000 qr. against 81,859,000 qr.; spring 33,741,000 qr. against 44,546,000 qr.; British India 39,739,000 qr. against 47,078,000 qr.; Japan 3,055,000 qr. against 3,224,000 qr.; Tunis 895,000 qr. against 1,377,000 qr. *Rye*—Spain 3,667,000 qr. against 3,044,000 qr.; Italy 643,000 qr. against 509,000 qr.; Switzerland 277,000 qr. against 240,000 qr.; United States 5,132,000 qr. against 5,737,000 qr. *Barley*—Spain 10,122,000 qr. against 9,929,000 qr.; Italy 1,322,000 qr. against 1,326,000 qr.; Switzerland 79,000 qr. against 71,000 qr.; United States 24,593,000 qr. against 28,432,000 qr.; Japan 11,975,000 qr. against 12,100,000 qr.; Tunis 826,000 qr. against 1,377,000 qr. *Oats*—Spain 3,583,000 qr. against 3,789,000 qr.; Italy 2,967,000 qr. against 3,224,000 qr.; Switzerland 670,000 qr. against 575,000 qr., United States 135,039,000 qr. against 157,942,000 qr.; Tunis 212,000 qr. against 353,000 qr.

Live Stock in Norway.—The numbers of animals on the 30th September, 1915, were as follows, the figures for the corresponding date in 1914 being shown in brackets: horses 186,217 (182,432); cattle 1,120,517 (1,146,274); sheep 1,329,559 (1,326,850); goats 240,303 (236,805); pigs 208,522 (228,117). (*Bulletin of Agricultural and Commercial Statistics*, July, 1916).

Live Stock in Canada.—The numbers of farm stock on the 30th June, 1916, were as follows, the numbers on the corresponding date in 1915 being shown in brackets: horses 2,990,635 (2,996,099); milch cows 2,603,345 (2,666,846); other cattle 3,826,519 (3,399,155); sheep, 1,965,101 (2,038,622); pigs 2,814,672 (3,111,900). (*Bulletin of Agricultural and Commercial Statistics*, July, 1916).

France.—According to an official report, the average condition of the crops on 1st July was as follows (figures for July, 1915 in brackets): winter wheat, 67 (68); spring wheat, 65 (69); rye, 69 (71); maize, 68 (74); winter barley, 72 (73); spring barley, 72 (69); winter oats, 72 (71); spring oats, 71 (68); and potatoes, 68 (69) (60=fairly good; 80=good). (*London Grain, Seed and Oil Reporter*, 27th July).

Canada.—The Census and Statistics Office at Ottawa in a bulletin, issued on the 3rd July, states that the prospects for grain crops are excellent throughout the west; but, the crops being about ten days later than last year, much will depend upon freedom from early frosts.

According to a later report, the area sown with wheat is estimated at 11,517,600 acres; oats 10,644,000 acres; barley 1,397,900 acres; and hay and clover 7,974,000 acres.

United States.—The Crop Reporting Board of the Department of Agriculture, in reporting on crop conditions on 1st August, states that the total production of winter wheat is estimated at 455,000,000 bush. as compared with 655,045,000 bush. last season; spring wheat at 199,000,000 bush. against 356,460,000 bush.; maize at 2,777,000,000 bush. against 3,054,000,000 bush.; oats at 1,274,000,000 bush. against 1,540,362,000 bush.; barley at 195,000,000 bush. against 237,009,000 bush.; and linseed at 14,000,000 bush. against 13,845,000 bush. last season. (*Broomhall's Corn Trade News*, 9th August.)

Russia.—According to the official "Trade Gazette" of Petrograd the condition of grain crops in general improved during June, and was fully satisfactory at the end of that month, winter crops being above average and spring crops average. (*H.M. Commercial Attache*).

Japan.—The growth of wheat, barley and rye has been somewhat checked by unfavourable weather, which improved during May and June. The total production for this season was estimated on 4th June at 14,284,500 qr, a decrease of 3·1 per cent. as compared with last season and an increase of 3·5 per cent. on an average year. (*H.M. Ambassador at Tokio*).

Denmark.—A report issued by the Danish Statistical Bureau on the prospects of the harvest states that on the 15th June the condition of the crops was favourable, spring sown being relatively the best. Wheat, barley and oats promise rather over average yields, and rye is quite up to average. In Langeland only, wheat is expected to give a yield below normal. The condition of rye is average on the Islands and rather better in Jutland.

Root crops are better on the Islands than in Jutland, but are not so favourable, on the whole, as grain crops. Potatoes, carrots and turnips promise average yields, but sugar beet and mangolds are rather under average.

The hay harvest promises well, both as regards quantity and quality, especially in Jutland. All kinds of hay are expected to give over average yields.

A later report, dated 12th July, stated that the condition of grain crops slightly improved between 15th June and 1st July. In a few cases root crops, especially beet, deteriorated, owing to lack of sunshine and warmth. The prospects of the hay and grass fields were far more favourable on 1st July as regards quantity, but the quality was not so good, especially in the case of hay, which was damaged to a considerable extent by the continuous rain.

Agricultural Conditions in England and Wales on 1st August.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st August, state that the weather was everywhere cold for quite two-thirds of the month, with night frosts in some localities, but that the last ten days were generally sunny and warm. Crops consequently made but little progress at first, but grew rapidly towards the end of the month.

Wheat is the best of the three cereals, but is hardly an average, except in the North; it is, however, quite healthy, and distinct improvement may be recorded on the month. Barley and oats are not so good, they are often poor and a thin plant; barley has improved as compared with a month ago, but prospects for oats remain about the same. Winter oats are much better than spring-sown, and cutting of the former has commenced in early districts. Beans are the most satisfactory of the corn and pulse crops, being at present rather over average; and peas are not far short of an average.

Potatoes are a very even crop throughout the country, they are healthy and vigorous, and little disease is mentioned; their yield should be quite up to the average or rather over.

Turnips and swedes, with a few exceptions, have come up well, and they nearly everywhere look promising. Owing to the lateness of the season, however, the area will probably be reduced; and the shortness

of labour is making it difficult to keep weeds down, and such cultivation is sometimes being neglected. Mangolds have greatly benefited by the warm weather; they are, however, so backward that it is not expected that their yield will be up to the normal.

The hay harvest, in the earlier districts especially, has been protracted and the constant showers have had their effect on the quality, which is only moderate in the case of hay secured before the middle of the month. In the last ten days, however, work proceeded rapidly, and much good hay was made in good condition. The yield, both of clover and meadow hay, is abundant, especially in the eastern counties.

Small fruit has yielded better than was forecasted a month ago; strawberries have been quite up to average, while raspberries, currants and gooseberries have all been large crops, especially the last named. Apples and pears are nearly everywhere very unpromising. Plums promise a poor yield on the whole, but they are very variable, and certain localities report abundance. Cherries have also been variable; they are about average on the whole, but poor in Kent.

Hops continued to develop very slowly until the middle of the month, when the warm weather effected an improvement, and growth became rapid. There has this year been much less aphis, and consequently less washing, than usual; but mould is more serious in Kent than for several seasons past. No change is indicated since the 1st July in the probable yield, which is still nearly 5 per cent. short in the Kent district, but just about average in the western area.

Pastures have now plenty of grass everywhere, although a very few areas are reported to show signs of bareness. Live stock have generally, but not universally, done very well.

Summarising the returns, and expressing an average crop by 100, the appearance of the crops on the 1st August indicated probable yields per acre which may be denoted by the following percentages: Wheat, 98; barley, 97; oats, 95; beans, 101; peas, 98; potatoes, 101; mangolds, 96; seeds' hay, 109; meadow hay, 107; hops, 96.

Agricultural Labour in England and Wales during July.

ACCORDING to statements in the Board's *Monthly Agricultural Report* (1st August) labour was still everywhere very deficient; but, owing largely to the assistance of women and soldiers, the scarcity was not felt so badly as was feared for the haymaking and fruit-picking. Turnip-hoeing was, however, much neglected in many parts of the country.

The following summaries give details for the different districts:—

Northumberland, Durham, Cumberland, and Westmorland.—Labour was scarce, but soldiers, and to a less extent women and children, have been helping, so that the deficiency in the hayfield was not as acute as was expected; but there was great shortage of hands for turnip-singling.

Lancashire and Cheshire.—The good weather during the hay harvest, and some help from the military, together with the use of machinery, assisted farmers to a great extent, and the great shortage of casual labour was not so severely felt as was expected.

Yorkshire.—Labour was inadequate for haymaking and turnip hoeing. Help was being rendered by Irishmen, women and soldiers, but the quality of the labour was poor, and wages high.

Shropshire and Stafford.—Labour was scarce; in Shropshire soldiers gave much help in hay-making. Turnip-hoeing was very much in arrears.

Derby, Nottingham, Leicester and Rutland.—Labour was still generally deficient. The employment of women and soldiers was reported from some districts.

Lincoln and Norfolk.—Labour was generally deficient; in some districts soldiers and women have been of great assistance, but in others they have been less employed.

Suffolk, Cambridge and Huntingdon.—Labour was deficient. Female labour was used to a great extent, and in some parts was the only casual labour obtainable.

Bedford, Northampton and Warwick.—The supply of labour was still very deficient, but the employment of women was reported from nearly all districts.

Buckingham, Oxford and Berkshire.—Labour was scarce, and in South Buckingham pea and fruit picking were both delayed from this cause.

Worcester, Hereford, and Gloucester.—The deficiency was very marked, although valuable assistance was being given in many districts by women.

Cornwall, Devon, and Somerset.—The supply of labour was still deficient, but the employment of women and boys to a small extent was reported. In south-west Cornwall wages were stated to have risen about 10 per cent. during July.

Dorset, Wiltshire and Hampshire.—The supply of labour is still deficient, but women were reported to have rendered excellent service.

Surrey, Kent, and Sussex.—Labour was very deficient throughout the division, though women labour for fruit picking was not quite so scarce as was anticipated in some districts.

Essex, Hertford, and Middlesex.—The scarcity was still acute, but women were helping in some districts, and the favourable weather minimised requirements.

North Wales.—The deficiency of labour for hay harvest was being mitigated to a great extent by the help of soldiers and the mutual co-operation of farmers.

Mid Wales.—Labour was very scarce, but the seasonable weather enabled the hay harvest to be cheaply secured.

South Wales.—Labour was very deficient, and the quality of that available was poor.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st August, 1916, certain diseases of animals existed in the countries specified:—

Austria (on the 28th June).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of June).—Anthrax, Foot-and-Mouth Disease (8 outbreaks), Swine Erysipelas.

France (for the period 2nd—15th July).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—30th June).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of June).—Anthrax, Foot-rot, Foot-and-Mouth Disease, Swine Erysipelas.

Hungary (on the 28th June).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 3rd—9th July).—Anthrax, Black-leg, Foot-and-Mouth Disease, (413 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of June).—Anthrax, Blackleg, Swine Fever.

Rumania (*for the period* 1*st*—8*th May*).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (*month of Feb.*)—Anthrax, Cattle-plague, Foot-and-Mouth Disease (19,179 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of Feb.*).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of June*).—Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (*for the period* 10*th*—16*th July*).—Anthrax, Blackleg, Foot-and-Mouth Disease (10 " étables " entailing 156 animals, of which 3 " étables " were declared infected during the period),

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during July.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending July 8th:								
England, N.E. ...	55·5	−3·0	0·74	19	+ 7	4	3·1	−3·6
England, E.	58·2	−2·1	0·48	12	+ 1	4	4·5	−2·9
Midland Counties ...	57·0	−2·8	0·85	22	+10	4	3·6	−3·1
England, S.E. ...	58·2	−2·7	0·56	14	+ 4	3	6·1	−1·5
England, N.W. ...	55·5	−3·0	0·77	20	+ 5	4	3·3	−3·1
England, S.W. ...	56·6	−2·7	0·98	25	+12	3	5·5	−1·5
English Channel ...	57·7	−2·9	0·58	15	+ 4	3	7·5	−1·0
Week ending July 15th:								
England, N.E. ...	55·9	−2·8	0·84	21	+ 9	5	4·6	−1·8
England, E.	57·5	−3·0	0·37	9	− 4	4	4·2	−2·9
Midland Counties ...	56·4	−3·6	0·37	9	− 4	4	3·8	−2·5
England, S.E. ...	57·3	−4·1	0·29	7	− 5	3	4·0	−3·3
England, N.W. ...	55·7	−3·0	0·64	16	0	4	3·4	−2·8
England, S.W. ...	56·6	−3·0	0·34	9	− 7	3	4·2	−2·4
English Channel ...	58·6	−2·5	0·14	4	− 9	3	8·1	0·0
Week ending July 22nd:								
England, N.E. ...	58·8	+0·1	0·45	11	− 3	4	3·8	−2·4
England, E.	58·8	−1·8	0·34	9	− 6	3	4·3	−2·4
Midland Counties ...	60·0	0·0	0·33	9	− 6	3	4·5	−1·3
England, S.E. ...	60·4	−1·0	0·19	5	− 9	2	6·0	−0·8
England, N.W. ...	59·3	+0·3	0·11	3	−15	2	4·5	−1·1
England, S.W. ...	60·6	+0·5	0·06	2	−17	1	8·0	+1·9
English Channel ...	61·1	−0·3	0·04	1	−13	2	9·0	+1·5
Week ending July 29th:								
England, N.E. ...	60·2	+1·6	0·05	1	−16	1	7·7	+2·1
England, E.	58·4	−2·1	0·03	1	−13	2	5·0	−1·2
Midland Counties ...	61·8	+1·8	0·07	2	−14	1	8·5	+2·9
England, S.E. ...	60·6	−0·9	0·00	0	−14	0	6·9	+0·5
England, N.W. ...	62·2	+3·2	0·03	1	−19	1	10·0	+4·6
England, S.W. ...	62·4	+2·3	0·02	1	−18	1	10·1	+4·2
English Channel ...	62·4	+0·9	0·00	0	−14	0	7·8	+0·4

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	31	35	348	393
Animals attacked	34	50	409	451
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	8	8	33	34
Animals attacked	16	23	85	63
Parasitic Mange:—				
Outbreaks	135	122	1,635	540
Animals attacked	222	268	3,699	1,179
Sheep-Scab:—				
Outbreaks	1	3	178	159
Swine Fever:—				
Outbreaks	427	415	3,042	2,747
Swine Slaughtered as diseased or exposed to infection	354	1,583	8,439	12,360

The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	1	—	3	1
Animals attacked	1	—	7	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	7	8	44	44
Sheep-Scab:—				
Outbreaks	28	14	254	268
Swine Fever:—				
Outbreaks	41	22	200	162
Swine Slaughtered as diseased or exposed to infection	298	88	1,183	910

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in July and June, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	July.		June.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	15 9	14 6	16 2	15 2
Herefords	15 2	13 11	15 9	14 7
Shorthorns	15 0	13 9	15 6	14 3
Devons	14 11	13 0	15 3	13 7
Welsh Runts	—	14 3	—	14 0
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	13½	12	13½	12¾
Sheep :—				
Downs	13	12	13½	12¼
Longwools	12	11¼	12¾	11¾
Cheviots	14	12¾	14¾	13½
Blackfaced	13¾	12¾	14½	12¾
Welsh	12¾	11¼	13½	12¼
Cross-breds	13	12	13¾	12½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 5	11 10	12 3	11 5
Porkers	13 2	12 8	13 2	12 6
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	34 3	27 0	33 19	27 3
,, —Calvers ...	33 19	26 19	32 12	25 19
Other Breeds—In Milk ...	30 16	24 10	31 11	24 8
,, —Calvers ...	26 0	23 0	24 0	22 0
Calves for Rearing	3 16	3 0	4 0	3 3
Store Cattle :—				
Shorthorns—Yearlings ...	14 8	12 17	15 5	13 6
,, —Two-year-olds...	22 5	18 12	22 19	19 12
,, —Three-year-olds	28 13	24 17	31 19	26 12
Herefords —Two-year-olds...	21 16	18 16	23 0	19 15
Devons— ,,	22 5	18 16	24 0	19 15
Welsh Runts— ,,	20 3	18 7	23 12	19 13
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	53 2	43 9	65 4	57 8
Store Pigs :—				
8 to 12 weeks old	38 2	30 0	39 11	31 10
12 to 16 weeks old	58 1	46 5	59 0	47 8

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in July, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—						
English	1st	103 0	104 0	—	105 0	101 0
	2nd	98 0	100 6	—	98 6	96 0
Cow and Bull	1st	92 6	99 0	90 0	88 6	87 6
	2nd	86 6	92 6	74 6	84 0	80 0
Irish: Port Killed	1st	99 6	99 0	98 6	102 0	97 6
	2nd	96 0	95 0	93 6	95 6	93 6
Argentine Frozen—						
Hind Quarters	1st	86 6	—	—	—	—
Fore "	1st	74 6	—	—	—	—
Argentine Chilled—						
Hind Quarters	1st	89 6	86 6	86 6	88 6	86 6
Fore "	1st	74 6	71 0	70 6	71 6	70 6
Australian Frozen—						
Hind Quarters	1st	—	—	84 0	—	84 0
Fore "	1st	—	—	74 6	—	74 6
VEAL:—						
British	1st	116 6	—	—	120 0	—
	2nd	106 6	—	100 6	104 0	98 0
Foreign...	1st	—	—	—	—	—
MUTTON:—						
Scotch	1st	102 6	—	105 0	122 6	110 6
	2nd	93 6	—	99 0	115 0	106 0
English...	1st	116 0	113 0	—	115 0	106 0
	2nd	107 6	104 0	—	105 6	101 6
Irish: Port Killed	1st	102 6	—	100 6	108 0	102 6
	2nd	93 6	—	95 6	100 0	98 0
Argentine Frozen	1st	90 6	87 6	84 6	90 6	84 6
Australian "	1st	83 6	—	—	85 0	—
New Zealand "	1st	83 6	—	—	85 0	—
LAMB:—						
British	1st	116 6	119 0	110 0	125 0	119 0
	2nd	111 0	109 6	99 0	115 6	109 6
New Zealand	1st	95 6	98 0	95 6	93 6	95 6
Australian	1st	97 0	—	—	93 6	—
Argentine	1st	104 6	99 6	98 0	104 6	98 0
PORK:—						
British	1st	111 6	104 0	101 6	104 6	90 0
	2nd	106 0	99 0	93 6	95 0	79 6
Frozen	1st	79 6	85 6	88 6	87 0	—

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in July, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	18 0	17 0	—	—	18 0	17 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	162 0	155 6	160 0	156 0	163 6	159 6
„ Factory	146 6	140 0	146 6	140 0	150 0	140 0
Danish...	—	—	172 6	170 6	175 0	172 0
French...	—	—	—	—	155 0	150 0
Russian	—	—	—	—	140 0	130 0
Canadian...	—	—	—	—	163 0	160 0
Australian	160 0	158 0	—	—	161 0	157 0
New Zealand	170 0	166 0	—	—	170 0	166 0
Argentine	162 0	158 0	—	—	161 6	157 6
CHEESE:—						
British—						
Cheddar	107 0	101 0	110 6	106 0	106 0	99 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	98 6	94 6	110 0	103 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	93 0	90 6	92 0	89 6	92 0	89 0
BACON:—						
Irish (Green)	115 0	110 0	113 6	110 0	112 6	109 0
Canadian (Green sides)	101 0	96 6	100 0	94 6	103 0	98 0
HAMS:—						
York (Dried or Smoked)	158 0	154 0	—	—	158 0	152 0
Irish (Dried or Smoked)	—	—	—	—	150 0	144 0
American (Green) (*long cut*)	90 6	87 6	91 0	87 0	92 0	88 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	18 4	—	—	—	18 4	17 3
Irish	17 2	—	16 9	15 10	17 4	16 8
Danish	—	—	—	—	19 4	17 10
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Duke of York... ...	280 0	190 0	—	—	295 0	271 6
White Kidney ...	275 0	190 0	300 0	265 0	275 0	256 6
Other First Earlies ...	276 6	186 6	255 0	215 0	256 6	226 6
HAY:—						
Clover...	—	—	185 0	142 6	148 0	138 6
Meadow	—	—	—	—	148 6	137 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.			BARLEY.			OATS.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 8 ...	30 11	46 2	55 8	25 11	29 7	47 8	18 4	26 5	31 5
„ 15 ...	31 0	48 9	56 7	26 0	30 5	48 6	18 6	27 6	31 11
„ 22 ...	30 11	51 6	57 2	26 3	31 3	49 6	18 11	28 10	32 6
„ 29 ...	31 1	52 8	58 0	26 6	32 5	51 0	19 1	29 10	32 11
Feb. 5 ...	31 0	53 3	58 3	26 7	33 7	52 5	18 9	30 3	32 4
„ 12 ...	31 0	54 8	57 6	26 7	34 7	52 10	18 11	31 1	32 2
„ 19 ...	31 0	56 0	56 11	26 7	34 11	53 6	18 11	31 5	31 9
„ 26 ...	31 0	56 0	58 2	26 6	35 3	54 2	18 11	31 8	32 2
Mar. 4 ...	31 5	55 11	59 4	26 2	34 6	55 7	18 9	31 8	32 4
„ 11 ...	31 6	54 8	58 2	26 0	33 5	55 6	18 7	31 0	32 3
„ 18 ...	31 5	53 9	57 9	25 8	32 2	55 4	18 6	30 7	31 10
„ 25 ...	31 4	54 3	55 11	25 7	31 11	54 6	18 8	30 6	31 4
Apl. 1 ...	31 6	54 6	53 6	25 6	31 9	53 8	18 5	30 6	30 5
„ 8 ...	31 5	54 9	51 8	26 8	31 3	53 7	18 4	30 4	30 1
„ 15 ...	31 7	55 4	53 2	25 4	30 10	53 1	18 4	30 5	30 7
„ 22 ...	31 9	56 5	55 3	26 6	31 5	52 10	18 5	30 11	31 8
„ 29 ...	31 9	58 3	56 3	26 0	32 7	53 5	18 5	31 5	32 4
May 6 ...	32 2	60 5	55 7	25 6	33 3	53 1	18 9	32 4	32 10
„ 13 ...	32 7	61 7	55 5	26 3	34 0	53 5	18 11	32 5	33 1
„ 20 ...	33 0	62 0	55 0	25 10	34 1	52 10	19 0	32 8	33 0
„ 27 ...	33 9	61 11	54 7	26 1	34 8	52 9	19 4	32 7	33 4
June 3 ...	34 0	61 9	53 3	25 11	35 4	53 9	19 4	32 5	33 3
„ 10 ...	34 1	60 1	51 2	24 11	34 5	52 8	19 8	32 4	32 7
„ 17 ...	34 1	56 1	48 10	25 10	34 3	50 9	19 9	31 9	32 1
„ 24 ...	34 3	52 0	47 6	25 4	34 4	49 10	20 0	31 9	31 3
July 1 ...	34 4	49 5	46 3	24 6	35 3	49 1	19 9	31 1	30 10
„ 8 ...	34 2	50 1	46 3	24 9	34 7	45 6	20 0	31 6	30 8
„ 15 ...	34 1	52 7	48 11	24 2	35 8	47 5	19 10	31 6	31 6
„ 22 ...	34 0	53 10	51 6	24 7	35 10	48 8	19 9	32 1	32 3
„ 29 ...	34 2	55 3	53 5	25 9	36 1	47 2	19 8	31 1	32 5
Aug. 5 ...	34 9	55 4	55 1	25 2	35 7	46 1	19 1	31 5	32 9
„ 12 ...	40 3	55 2		29 4	37 0		25 1	31 7	
„ 19 ...	38 9	54 3		29 10	39 4		24 3	31 4	
„ 26 ...	36 2	51 11		30 3	38 3		23 5	30 0	
Sept. 2 ...	36 5	45 3		30 6	38 1		23 9	26 10	
„ 9 ...	37 10	43 0		29 11	37 11		23 11	26 8	
„ 16 ...	38 3	42 9		29 5	39 0		23 8	26 4	
„ 23 ...	37 6	43 3		29 3	39 8		23 3	26 1	
„ 30 ...	37 1	43 5		29 1	40 4		22 9	26 5	
Oct. 7 ...	36 8	44 1		28 10	41 0		22 5	26 5	
„ 14 ...	36 7	45 9		28 8	42 3		22 4	27 1	
„ 21 ...	37 2	48 2		28 7	44 0		22 5	28 1	
„ 28 ...	37 10	50 3		28 3	46 2		23 7	29 1	
Nov. 4 ...	38 8	51 6		28 6	47 3		23 7	30 4	
„ 11 ...	39 8	52 8		29 0	47 5		24 8	30 11	
„ 18 ...	41 0	53 6		29 8	47 11		25 5	31 3	
„ 25 ...	41 11	54 2		30 3	48 7		25 8	31 1	
Dec. 2 ...	42 2	53 7		30 2	48 11		25 9	30 11	
„ 9 ...	42 1	52 10		29 11	47 10		25 9	30 4	
„ 16 ...	42 7	53 11		29 8	47 5		25 9	30 6	
„ 23 ...	43 3	53 10		29 9	47 2		25 11	30 7	
„ 30 ...	44 4	54 9		29 10	47 5		26 6	30 10	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of July, 1914, 1915, and 1916.

—	Wheat. 1914.		Wheat. 1915.		Wheat. 1916.		Barley. 1914.		Barley. 1915.		Barley. 1916.		Oats. 1914.		Oats. 1915.		Oats. 1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	34	11	54	10	50	11	24	8	36	3	48	6	20	9	32	11	33	4
Norwich ...	34	2	51	1	50	0	25	0	36	3	—		19	3	32	6	32	1
Peterborough	33	8	52	10	49	11	23	11	34	9	44	6	19	5	31	9	31	11
Lincoln ...	34	1	51	4	52	5	25	0	33	0	46	10	20	6	31	9	32	1
Doncaster ...	33	10	50	8	48	9	—		34	3	—		19	5	30	11	31	7
Salisbury ...	33	6	50	11	50	10	—		35	5	49	1	19	5	31	2	31	0

NOTICES OF BOOKS.

The Principles of Rural Credits as applied in Europe and as suggested for America: James B. Morman, A.M., with an introduction by John Lee Coulter, Ph.D., [*New York*: The Macmillan Company, 1915 (The Rural Science Series, L. H. Bailey, Editor). 5*s.* 6*d.* net.]

In the spring of 1913 the Southern Commercial Congress, an organisation interested in the development of agriculture in the Southern States, brought together a commission, named the American Commission, to study personally in the various European countries all phases of agricultural co-operation and rural credits. Under authority of Congress, President Wilson appointed a second commission, entitled the United States Commission on Rural Credits, to co-operate with the American Commission. The whole of the materials collected were published in a volume of some 900 large pages as Senate Document No. 214, Sixty-third Congress, First Session. Dr. Coulter was a member and secretary of the United States Commission, and also a member of the American Commission and secretary of the Committee charged with the preparation of its final report. In order to popularise the principal [illegible] he sugge[illegible]d to Mr. Morman the preparation of the present volume, [illegible]ing how farmers may be successfully financed.

[illegible] "the Methods of Financing Farmers in Europe" in [illegible] Personal Credit for the Landowning Farmer; II. [illegible] Particular; III. Government Aid for Promoting [illegible] Landowning Farmers; IV. Personal Credit for [illegible]. Co-operative Farm Mortgage or Long-time [illegible]n-co-operative Farm Mortgage or Long-time [illegible]pter summarising the "Characteristics of [illegible] Part II. deals with "A Constructive [illegible] Farmers," incidentally giving accounts [illegible]een adopted in different parts of the [illegible]ralasia. (There are further chapters

American [illegible]en) (long cut)		
EGGS :—		
British		
Irish		
Danish		
POTATOES :—	per ton	
Duke of York... ...	280	0
White Kidney ...	275	0
Other First Earlies ...	276	6
HAY :—		
Clover	—	
Meadow	—	—

on the rural credit problem, conditions of rural credit, means of promoting rural credits, the issue of farm mortgage bonds, regular mortgage loans to farmers, the financing of tenant farmers, and various other matters relating to rural credit). The volume has a bibliography comprising works written in English, French, German and Italian, and an index.

Women and the Land: Viscountess Wolseley. (230 pp.) [*London:* Chatto and Windus, 1916. 5*s.* net.]

This volume is written with the object of directing the attention of women to subjects connected with the land. Topics "which may interest the practical woman farmer and market gardener" are treated, but the volume is "meant more especially to convey suggestions for good, sound, lasting work which could be carried out advantageously by lay people, those who have hitherto only been distantly brought into touch with food supplies and rural subjects." Portions of the text have already appeared in *The Nineteenth Century* and *The Contemporary Review*.

Following an introduction of 17 pages are eleven chapters dealing successively with the various advantages of increased interest of women in the land and the need for improved rural education and co-operation, professional women farmers, etc. The question of settlement of educated men and women on the land receives special consideration. The future peasant class, co-operation in agriculture, women's institutes (with particular reference to the social problem), the importance of teaching gardening and building up small holdings and market gardening, better housing for the labourer, the wages of the rural labourer, village industries, the education of village women and girls, and the woman gardener of the future, all find a place in this volume, which contains 16 photographic illustrations.

Poultry Diseases: E. J. Wortley, [*London:* Kegan Paul, Trench, Trübner & Co.; *New York:* Orange Judd Company, 1915].

This book is intended to serve as a guide to the practical poultry-keeper. In the opening chapter emphasis is laid on the importance of controlling disease, and detailed information is given as to approved methods of control. The external symptoms of various diseases, with concise directions for treatment, are presented in a convenient tabular form in chapter 2.

In chapter 5 the method of conducting a post-mortem examination is described, and the author dwells on the importance of the poultry keeper making himself acquainted with the appearance of the internal organs of the fowl. The normal condition of these organs is described and the main diagnostic symptoms discernible by the naked eye are arranged under the headings of the organs affected.

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THE VALUE OF IMMATURE POTATO TUBERS AS SEED.

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MANY practical potato growers believe that tubers lifted in an immature or unripe condition, give better yields than tubers of the same varieties which have been allowed to remain in the ground until their full development has been attained.

This idea is not new. The Rev. John M. Wilson (1849) states, [1]* "Green tubers, or tubers which are full of vegetative sap, or which have never ripened to dryness, are, in all circumstances, the best, and were often found to secure health and vigour in a crop during a season in which taint (rot of tubers in the ground) was prevalent;" and Professor John Wilson (1859) states, [2] "Many growers are of opinion that the unripe tuber produces stronger plants than the fully matured."

In more recent years experiments on the subject have been carried out by Messrs. Sutton & Sons, Armstrong College, Leeds University, the Midland Agricultural and Dairy College and others, the results of which have been generally in favour of immature seed.

Messrs. Sutton & Sons, in 1912, wrote, "We have proved absolutely beyond contradiction that immature seed gives infinitely better crops than mature seed." The results of their experiments carried out in 1906 with the varieties Ashleaf, May Queen, Duke of York, Factor, Up-to-Date and Discovery seem to justify this statement.

Garforth Experiments.—The Garforth 1905–06 experiments are important because they give results obtained at a North of

* The References will be found on p. 539.

England centre with mid- and late-season varieties in which the immature seed was raised late in the year.

Table I. gives a summary of the results of the Garforth experiments in 1905.(3)

TABLE I.

Variety.	Yield per acre.				Balance in favour of Immature Seed.	
	From Immature Seed.		From Mature Seed.			
	Whole sets.	Cut sets.	Whole sets.	Cut sets.	Whole sets.	Cut sets.
	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.
*British Queen	12 11 3	12 0 0	11 13 1	11 1 3	0 18 2	0 18 1
**Royal Kidney*	*13 1 3*	*12 11 3*	*11 11 2*	*12 2 1*	*1 10 1*	*0 9 2*
†Charles Fidler	10 18 1	11 12 2	10 19 1	—	nil	—
†Empress Queen	11 0 3	9 19 1	10 5 3	—	0 15 0	—
†Up-to-Date	10 4 3	10 14 1	10 2 2	—	0 2 1	—

* Previously grown twice on farm. † Previously grown once on farm.

Table II. gives the dates when the seed which produced the above results was raised and the yields at the times.

TABLE II.

Variety.	Immature.		Mature.	
	Date when lifted.	Yield per acre.	Date when lifted.	Yield per acre.
		T. c. q.		T. c. q.
British Queen ..	13 Sep., 1904	—	18 Oct., 1904	—
Royal Kidney ..	15 ,, ,,	—	28 ,, ,,	—
Charles Fidler ..	27 ,, ,,	12 16 1	28 ,, ,,	13 5 0
Empress Queen ..	27 ,, ,,	12 4 1	28 ,, ,,	12 11 3
Up-to-Date ..	28 ,, ,,	13 11 0	31 ,, ,,	14 13 3

Table III. summarises the results of an experiment carried out at Garforth in 1906(4), different methods of storing the seed being tested at the same time.

TABLE III.

Variety.	Yield per acre.	
	Mature Seed.	Immature Seed.
	T. c. q.	T. c. q.
Royal Kidney, seed "boxed" ..	12 10 0	11 5 3
,, ,, ,, "pied"	10 12 1	9 2 1
Dalmeny Beauty, seed "boxed" ..	11 11 0	11 14 0

Table IV. gives the dates on which the seed which produced the above results was raised and the yields per acre at the times.

TABLE IV.

Variety.	*Mature.* Lifted 16-18 Oct., 1905.	*Immature.* Lifted 23 Sept., 1905.
	T. c. q.	T. c. q.
Royal Kidney	13 2 1	8 17 2
Dalmeny Beauty	10 18 2	9 14 3

In Table V. the results of experiments at Garforth (4) on late planting to secure immature seed are shown.

TABLE V.

Variety.	Yield per acre.				Advantage + Disadvantage — with Immature Seed.	
	Mature Seed.		Immature Seed.			
	Whole sets.	Cut sets.	Whole sets.	Cut sets.	Whole sets.	Cut sets.
	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.
*Charles Fidler	6 5 1	6 19 1	6 0 0	6 14 0	—0 5 1	—0 5 1
*Wonder	10 5 3	9 12 3	11 11 0	11 0 3	+ 5 1	+1 8 0
†Up-to Date	9 13 1	10 5 3	10 12 3	9 9 3	+0 19 2	—0 16 0

* Previously grown four times on farm. † Previously grown three times on farm.

The dates when the seed which produced the above results was planted and the yields ultimately obtained on October 18-19th, 1905, are shown in Table VI.

TABLE VI.

Variety.	*Date of Planting.*	*Yields per acre.*
		T. c. q.
Charles Fidler................	16 May	6 19 1
,, ,, ...	24 June	4 2 2
Wonder	16 May	11 13 2
,, ...	24 June	6 15 0
Up-to-Date	17 May	10 5 3
,, ...	20 June	6 9 3

Wye and Midland College Experiments.—Experiments on the subject were commenced at the South-Eastern Agricultural College in 1912, repeated there in 1913 and continued at the Midland Agricultural College during the seasons of 1914 and 1915.

First year, 1912, at Wye.—The soil was derived from a Brick Earth deposit of from 2 to 3 ft. in thickness resting on chalk debris. The crop for the three previous years had been a mixture of lucerne and cocksfoot. In November, 1911, the land had been bastard trenched and allowed to lie rough until the following March. It was then cultivated to a fine tilth, ridged, manured at the rate of 10 cwt. per acre with a mixture of 3 parts superphosphate, 1 part sulphate of potash, 1 part sulphate of ammonia, 2 parts wood ashes and 3 parts poultry

manure, divided into two 13-rod plots (A and B), and planted during the second week in April with mature (Plot A) and immature (Plot B) tubers.

The immature tubers were obtained by lifting part of a crop of Factors, grown from fresh Scotch seed, at the end of July, 1911, and the mature tubers came from the same crop, which had been allowed to remain in the ground until October, 1911. The tubers were of the same size in each case and the cultivation, which the plots afterwards received, was alike. The crops were lifted in mid-October, and gave the following yields :—

TABLE VII.

	Ware.	*Seed.*	*Chats.*
Plot A (Mature seed) ..	108 lb.	14 lb.	17 lb. per rod.
,, B (Immature seed) ..	158 ,,	22 ,,	21 ,, ,,

The growing period was favourable. It was observed that the plants on Plot B were more advanced in growth, of a darker green colour, and more even in crop throughout the season than those on Plot A.

Second year, 1913, at Wye.—The land on which the experiments were carried out was similar to that taken in 1912 and was prepared in a similar way. The varieties, Epicure, Ninetyfold, Factor and Scottish Triumph were tested. The required quantities of mature and immature tubers had been obtained from crops grown on the College grounds in 1912, the immature tubers of the early varieties having been lifted in mid-July and those of the late varieties during the first week in August. In all cases the mature tubers were lifted in October.

Each plot was 2 rods in size. Conditions were made equal in every case and the tubers were planted on April 8th and 9th. There were six rows in each plot and each row contained the same number of tubers.

One row of each of the kinds of early varieties was lifted on June 27th and weighed immediately. The yields are shown in Table VIII.

TABLE VIII.

		Per Row. lb.	oz.		*Per Rod.* lb.	oz.
Epicure, Mature ..	Ware	10	2½	=	30	7½
	Chats	1	7	=	4	5
Epicure, Immature ..	Ware	14	4	=	42	12
	Chats	1	12	=	5	4
Ninetyfold, Mature ..	Ware	12	4	=	36	12
	Chats	3	8	=	10	8
Ninetyfold, Immature	Ware	16	2	=	48	6
	Chats	1	14	=	5	10

Similarly one row of each kind gave, on July 11th, the following yields :—

TABLE IX.

		Per Row. lb. oz.		Per Rod. lb. oz.
Epicure, Mature	Ware	14 4	=	42 12
	Chats	1 14	=	5 10
Epicure, Immature	Ware	18 11	=	56 1
	Chats	1 0	=	3 0
Ninetyfold, Mature	Ware	18 4	=	54 12
	Chats	1 11	=	5 1
Ninetyfold, Immature	Ware	21 8	=	64 8
	Chats	1 7	=	4 5

The remaining four rows of Epicure were lifted on July 20th and those of Ninetyfold on August 19th. The yields shown in Table X. were obtained.

TABLE X.

		Per Four Rows. lb. oz.		Per Rod. lb. oz.
Epicure, Mature	Ware	60 8	=	45 6
	Chats	7 8	=	5 10
Epicure, Immature	Ware	82 5	=	61 12
	Chats	7 5	=	5 8
Ninetyfold, Mature	Ware	72 0	=	54 0
	Seed	31 0	=	23 4
	Chats	14 0	=	10 8
Ninetyfold, Immature	Ware	89 0	=	66 12
	Seed	26 0	=	19 8
	Chats	13 4	=	9 15

The following notes were taken of the plots during the season:

EPICURE.

Date.	*Mature—Plot A.*	*Immature—Plot B.*
May 7	149 plants out	145 plants out, more advanced than those on Plot A.
May 21	Even growth. 1 missing, 7 backward.	Even growth. 1 missing, 10 backward.
June 11	5 plants in bloom. Tops turning yellow. Backward plants still behind rest.	46 plants in bloom. Better than Plot A, tops being stronger and of a better colour. Little yellowing of lower leaves. Backward plants still behind rest.
June 24	Plants ripening off	Still green, 7 of backward plants turning yellow.
June 27	Plants becoming yellower, 17 with dead tops.	Greener than Plot A. Backward plants yellow.
July 20	Majority of plants dead. Tops of rest pale green and yellow.	Similar to Plot A.

NINETYFOLD.

Date.	*Mature—Plot C.*	*Immature—Plot D.*
May 7	150 plants out	165 plants out.
May 21	Uneven. 3 plants missing, 12 backward.	Evenness of crop very marked. All out. Two rather backward.
June 11.	Uneven in growth and varying in intensity of green colour. Backward plants turning yellow. 2 plants in bloom.	A good even crop. Colour good. No yellowing, 37 plants in bloom.
June 27	Uneven. More yellow colour in leaves. Plants in full bloom.	Even crop. Better colour than Plot C. Bloom falling.
July 20	Foliage brownish green; lower leaves yellow.	Similar to Plot C.
Aug. 19	Tops dead	Similar to Plot C.

The plots of Factor and Scottish Triumph were raised on 17th October and the produce weighed immediately. The yields are shown in Table XI. :—

TABLE XI.

		Per Plot. lb.		Per Rod. lb.
Factor, Mature	Ware	126	=	63
	Seed	36	=	18
	Chats	78	=	39
Factor, Immature ..	Ware	140	=	70
	Seed	64	=	32
	Chats	44	=	22
S. Triumph, Mature ..	Ware	34	=	17
	Seed	82	=	41
	Chats	60	=	30
S. Triumph, Immature..	Ware	120	=	60
	Seed	58	=	29
	Chats	40	=	20

The season was unfavourable to the crops, especially during the latter part of summer. Rain did not fall in sufficient quantities for the requirements of the plants. The following notes were made during the season :—

FACTOR.

Date.	*Mature—Plot E.*	*Immature—Plot F.*
May 7 ..	21 plants out	61 plants out.
May 21 ..	14 plants not out, 26 backward. A fairly even crop.	5 plants not out, 10 backward. Much more even in growth than Plot E.
June 11 ..	5 plants missing	All plants out. Good even crop, better in colour and size of tops than Plot E.
June 27 ..	Growth uneven, 17 plants badly attacked by leaf curl. A few plants showing bloom.	Better than Plot E in uniformity of growth and colour. No leaf curl. All the plants but 2 showing bloom.
July 11 ..	Blooms beginning to drop earlier than on Plot F. Plot still uneven, 23 plants with leaf curl.	Plants in full bloom. Good colour and very even. 2 plants with leaf curl.
July 20 ..	Plants poor in colour—of a rusty brown appearance in the leaves as if growth had ceased. 27 plants have severe leaf curl and 9 others are attacked by a bacterial disease which has turned the foliage black. Almost all the bloom has dropped.	Plants still blooming. Tops not so good in colour as on July 11, needing rain. Much better in every way than Plot E.
Aug. 22 ..	A patchy crop. 11 plants have lost all their foliage. 36 plants have leaf curl.	All bloom has fallen. 4 plants badly attacked by leaf curl, 7 plants slightly attacked by leaf curl.

SCOTTISH TRIUMPH.

Date.	*Mature—Plot G.*	*Immature—Plot H.*
May 7 ..	6 plants out	61 plants out.
May 21 ..	An uneven plot. Many small plants. 43 not out.	4 plants not out, 6 rather backward. Bigger tops than Plot G, and much more even.
June 11 ..	Very uneven. No bloom showing.	An even crop, 13 plants in bloom and the majority in bud.

Date.	Mature—Plot G.	Immature—Plot H
June 27 ..	Very uneven. 32 backward plants.	Growth even and tops of good colour, 4 plants six in. high are dying off.
July 11 ..	32 plants much behind the rest in size of tops. 7 show leaf curl, 21 plants have dried up, dark brown leaves. The remainder are equal to those on Plot H.	7 plants have leaf curl. General appearance much better than Plot G.
July 28 ..	32 plants suffering from leaf curl, remainder shorter in top than those on Plot H.	16 plants show leaf curl and signs of dying. A better colour than Plot G.
Aug. 22 ..	No more plants attacked, remainder of fairly good colour.	Colour fairly good, 23 plants with leaf curl and foliage turning dark brown.

From this date the plots of Factor and Scottish Triumph showed a gradual decay of top and differences between the paired plots became less marked.

Third year, 1914, at the Midland Agricultural College.—The trial was carried out on a pebbly loam soil resting on Red Marl, which had grown a crop of wheat in 1913. The land received the usual cultivation given to the potato crop ; the manuring per acre was as follows : 20 loads of dung ploughed in during December, 3 cwt. basic slag sown on 16th April, and a mixture of 1½ cwt. sulphate of ammonia, 1½ cwt. superphosphate (32 per cent. sol.), 1 cwt. sulphate of potash, applied on 17th April. The plots consisted of four rows, each 16 yd. long with intervals of 26 in. ; 48 tubers were planted in each row.

The variety was Factor, grown at Wye in 1913, the immature tubers having been lifted at the end of July and the mature tubers in October. The crop was lifted in mid-October, when the following yields per acre were obtained :—

TABLE XII.

		Tons	cwt.	lb.		Tons	cwt.	lb.
Factor, Mature ..	Ware ..	7	9	12	Total	12	4	72
	Seed ..		18	84				
	Small ..	3	9	72				
	Diseased ..		7	16				
Factor, Immature ..	Ware ..	8	9	72	Total	13	9	80
	Seed ..		16	8				
	Small ..	2	15	40				
	Diseased ..		19	72				

"The unripe seed, therefore, gave the larger crop, and it will be noticed that the increase is in ware and also in diseased tubers, a fact which shows that the crop from the unripe seed was also earlier."

Fourth year, 1915, at the Midland Agricultural College.—The soil resembled that taken for the 1914 trial. The previous crop had been oats. The manuring per acre was : 15 tons dung

ploughed in during December, and a mixture of 3 cwt. superphosphate (32 per cent. sol.), 1 cwt. sulphate of ammonia and 1 cwt. muriate of potash, applied on 6th April. The plots comprised four rows, 27 in. apart and 48 ft. long, of each kind of seed; 48 tubers were planted in each row. The tubers had been grown on the College farm in 1914, the immature having been lifted on 9th September and the mature on 15th October. The tubers were of the same size in each case, having been dressed between a 1½-in. and 2¼-in. riddle. The cultivation after planting was the same in each case.

The crop was lifted on 9th October. Table XIII. shows the yields per acre.

TABLE XIII.

		Tons	cwt.	lb.		Tons	cwt.	lb.
King Edward, Mature	Ware	4	9	32	Total	6	4	62
	Seed		16	8				
	Small		18	84				
	Diseased			50				
King Edward, Immature	Ware	10	15	20	Total	12	19	42
	Seed	1	5	0				
	Small		17	46				
	Diseased		1	88				

"This year's result is, therefore, even more strikingly in favour of the unripe seed than that of 1914. The great superiority of the unripe seed was very marked during the whole growing season" ([6]).

Causes of the Superiority of Immature Seed.—The superiority of immature seed may be due to the following causes:—

1. *Method of Selection.*—In usual farming practice the tubers retained for planting purposes are of medium and smaller sizes, the larger tubers being sold as ware. This method of selection tends to give predominance in number to plants of medium and low productivity and, if continued for a number of successive years, will be a factor in accounting for the deterioration in cropping powers which varieties undergo. On the other hand, by raising the plants before growth is completed, the largest tubers of the crop being then of "seed" size and mostly derived from the most productive plants, are retained, with the resulting tendency to increase, or at least to maintain, previous productivity.

In support of this view Messrs. Sutton & Sons report a case (1906) where the Magnum Bonum variety had been grown continuously on an estate since 1876 without deterioration occurring. In this case the tubers were always raised before the crop had become thoroughly ripe and were planted as whole sets. By similar methods a practical Lincolnshire

grower grew Sharpe's Express continuously for 10 years without impairing the original productiveness of this variety.

2. *The Structure of the Tuber Coats.*—In contrast with that of mature tubers, the cortex of immature tubers is thinner, less firmly attached and capable of being more easily ruptured. This cortical layer rapidly increases in thickness during the late stages of growth and, as in the case of many kinds of seeds, increase in its thickness may be accompanied by changes in the composition of its tissues. The character of the tuber coat varies with the different varieties, and also in the same varieties when grown under different conditions of soil and climate. Warm, dry soils, such as some of those in Surrey and South Africa, favour this development and tubers grown on such lands are unsuitable as "seed." Scotch "seed" is grown under conditions which prohibit strong cortical development and this may account for the preference which such seed enjoys. As the thick cortical layer acts as a check on loss of water from within it may also act as a check on the rate of imbibition of water from without, which is necessary during the early stages of growth, and this action may be expected to be associated with different effects upon respiration and other physiological functions of the internal living tissues, the results of which would appear in the differences of growth shown by the two kinds of tubers.

3. *The Amount and Condition of the Reserve Food Material.*—It has been experimentally proved that wide differences exist in the amount of starch present in the tubers at different times in the year. Dr. Fromberg found (7) 5·53 per cent. of starch present in new potatoes, while the average percentage for several varieties of mature tubers was between 17 and 18. In the same variety this investigator found that the starch had increased from 16·73 to 21 per cent. in the two months immediately preceding its maturity, and the least ripe tubers contained 76 per cent. of water against 70 per cent. in the case of the ripest tubers. In determinations made at Wye in 1913 no constant difference was found in the amounts of sugar present in the two cases, but it may be that some transitory form of reserve food material is present in greater amount in immature tubers which is more readily available when spring growth commences.

4. *The Length of Time of Storage.*—Payen found that tubers of the same variety had fallen in starch percentage from 17·2 to 14·5, from October to April, according to the following table:—

Month.	*Starch content* (per cent.)	*Month.*	*Starch content* (per cent.)
October	17·2	February	15·2
November	16·8	March	15·0
December	15·6	April	14·5
January	15·5		

If starch be decomposed, giving rise to a more readily available form of plant food and the amount so decomposed increases with time, the advantage would be on the side of the immature tubers, which are given several weeks' longer storage.

The interruption of the vegetative processes caused by the premature removal of tubers is an interference with the *periodicity of the plant, from which results might be expected* different from those obtained by allowing the plant to complete its development.

To whichever of these or other causes the superiority of immature tubers is due, the first observable effect is to promote earliness and vigour of growth, and the plants become sufficiently developed to form tubers under the best seasonal conditions.

How to obtain Immature Seed.—It has been suggested that, in order to obtain immature seed, planting should be done about midsummer. This plan was adopted in the Garforth (1906) experiments, the immature seed planted that year having been obtained from tubers planted on 20-24th June and raised on 18-19th October, 1905. The cutting off of the tops when green, so arresting further development of tubers and allowing them to remain in the ground until autumn, has also been suggested, but the best practice will be found to be to plant at the usual time of the year and to raise the crop early.

The Wye experiments show that the disease causing leaf curl can be largely checked by using immature seed, and "blight" does less damage to the crop on account of the more advanced growth which has been made at the time of year when the plants are attacked by the disease.

At the present time the advantages which the planting of home-grown immature tubers would give should specially appeal to small holders, market gardeners, allotment holders and others having small plots of land, on account of the difficulty in obtaining good seed. The extra crop which could be obtained in the year would probably compensate for any loss in weight which might occur by raising the tubers before they were fully grown.

There is no difficulty in storing immature seed. In the Wye experiments the early lifted tubers were allowed to lie on the ground exposed to the weather for about three weeks. When dry they were gathered and placed in barrels, which were afterwards stored in a covered shed until the following year. In the autumn of the year, 1 cwt. of these was put into a clamp along with other seed. The tubers were quite sound when taken out in the following spring.

The following account of the experiences of a Lincolnshire grower who has followed the practice of using home-grown immature seed will be found valuable :—

"*28th June, 1916.* At first all potatoes go to market in two grades as picked off the field. Later, as the markets come down, they are only taken according to, say, a $1\frac{1}{2}$-in. riddle. The remainder are put on a $1\frac{1}{4}$ or $1\frac{1}{8}$ in. riddle and put straight into boxes and kept for seed. I grew Duke of York for 10 years in succession from the same stock and in the same garden. I found they grew more quickly and vigorously than from matured seed. The crop was lifted at the end of June or as soon as (or before) any disease showed in the tops. The small ones were taken out and the others placed in trays, stacked in the open until October, when they were brought in for the winter. These Duke of Yorks did well every year, keeping healthy and vigorous, and producing a good crop. At the end of 10 years they were planted in the field and allowed to mature The seed saved was also planted in the field, but did not produce a good crop, and the crop from that year's seed was practically a failure. The stock quickly grew out when the seed was allowed to mature. I later extended my experiment to the field, the variety being Eclipse. I found that several times grown (from Scotland) seed grew as strongly as Scotch seed and were ready to lift a week sooner than other matured seed. My brother has a few acres of Sharpe's Express from seed taken up in July last year, and boxed in this manner. They are twice grown from Scotland but look strong and rank in top and are doing well, considering time of planting and weather conditions. They may lift 4 or 5 tons in about a fortnight. Compared with mature seed, immature seed gives a crop of more vigorous growth, more freedom from disease and grub attack, an earlier and heavier crop, and the tubers are larger."

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(5) Report on the Field Trials on the College Farms, 1914 (by John Dunlop), *Midland Agricultural and Dairy College.*

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THE CITRIC SOLUBILITY OF BASIC SLAG.

IN a book on manures, published in 1894, the German chemist Wagner contended that the manurial value of the phosphoric acid in basic slag was related to its solubility in an acid solution of ammonium citrate; and therefore that the value of the basic slag depended not merely on its content of total phosphoric acid and its fineness of grinding, but also on its degree of solubility in the solution mentioned. These observations were confirmed in the same year by experiments at Halle in which a very close connection was shown to exist between "citric solubility" and the manurial value of basic slag. A resolution was carried by the Union of German Experiment Stations to the effect that thenceforth, with a given degree of fineness, basic slag should be sold according to its degree of solubility in an acid solution of ammonium citrate containing 1·4 per cent. of free citric acid. It was soon shown that the effective part of this solution was the free citric acid, the ammonium salt having only a very small solvent effect, and the ammonium salt solution was replaced by a 2 per cent. free citric acid solution, the latter dissolving more (viz. 107 : 100) basic slag phosphoric acid than the old ammonium citrate solution. The new method was accepted by the Union of German Experiment Stations in 1898, and since that date basic slag has been examined for solubility in Germany by means of a 2 per cent. solution of citric acid.

This method, known as the Wagner method, is often adopted in this country to determine whether the phosphate is likely to become "available" or useful to plants in a reasonable time, and is officially recognised in the Fertilisers and Feeding Stuffs Act and regulations made thereunder.

While this method has great practical convenience it cannot be denied that it is to a great extent empirical, and it has been attacked both here and in Germany. It is urged that the phosphate which does not dissolve in the 2 per cent. citric acid solution has considerable fertilising value.*

The Manurial Experiments Committee of the Union of German Experiment Stations decided at a session early in 1911 on new experiments with regard to the effect of the total phosphoric acid in basic slag. Nineteen slags containing

* See, e.g., a report of the Devon County Agricultural Committee issued in 1915, in which an account of experiments on the point is given.

phosphoric acid of very varying degrees of solubility were obtained and samples of each distributed to German experiment stations; experiments were carried on until the end of 1913, and reports from five stations, Bremen, Bromberg, Halle, Harleshausen and Möckern, obtained.

As a result of the reports the Union of German Experiment Stations decided that *there were no grounds for departing from the customary methods of evaluation of basic slag.*

The reports from the various stations are published in *Die Landw. Versuchs-Stationen*, Band LXXXVII. Heft ii. u. iii., and cover some 100 pages. It is proposed to give some account here of the results obtained.

Bremen.—In discussing the results at this experiment station it is pointed out that the problem is whether, *on the average*, there is agreement between citric solubility and availability; absolute agreement in one set of experiments cannot be expected owing to the influence of soil, etc., and accidents; thus the fineness of slags will be more important on sandy soils poor in carbonic and other acids than on soils containing considerable quantities of these acids, while on the other hand greater fineness on heavy, close soils (on which an even distribution of manure is difficult) gives a better availability on account of easier infiltration. Accordingly a different availability must be expected from different soils and it is sufficient if a tendency towards agreement between citric solubility and availability is obtained.

Pot experiments were carried out in 1911, 1912 and 1913, the soils being (1) a poor sandy soil, (2) a "low" moor, and (3) the sandy soil mixed with 2½ per cent. of the moor soil.* The soils were poor in phosphoric acid so that the phosphoric acid in the slags was fully usable. The crops were in the first year oats (followed by mustard in the case of soils 1 and 2), and in the second year rye. Soils 1 and 2 received slag (with other manures) in both years, while soil 3 received it in the first year only.

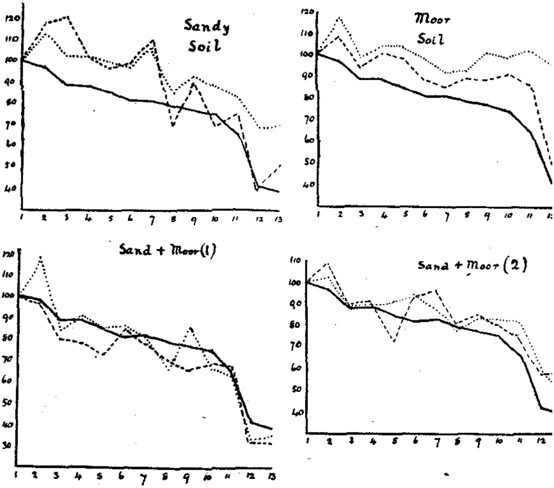
The following table (p. 542) shows the *increased* yields of dry matter in the crops harvested and the *increased* amounts of phosphoric acid taken up as a result of the basic slag application; the figures are reckoned in percentages of the first slag in the table, which contained 100 per cent. of citric soluble phosphate.

* The use of quartz sand for pot experiments is decried, as Wagner's experiments related to soils coming under cultivation; but see the Möckern experiments later.

Total Phosphate of Lime. $Ca_3P_2O_8$	Citric Soluble Phosphate of Lime.	Percentage of Citric Soluble P_2O_5 in total P_2O_5.	*Increased* yields of Dry Matter and *increased* amounts of Phosphoric Acid taken up.							
			Sandy soil.		Moor soil.		Sand + Moor soil.			
			1911 + 1912 crops, viz., oats, mustard, rye.		1911 + 1912 crops, viz., oats, mustard, rye.		1912 + 1913 crops, viz., oats and rye.			
							Slag in first year only.		Slag (double dressing) in first year only.	
			Dry Matter.	Phos. Acid.	Dry Matter.	Phos. Acid.	Dry Matter.	Phos. Acid.	Dry Matter.	Phos. Acid.
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
22·78	22·80	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
36·93	36·21	98·1	114·0	117·5	118·0	108·3	119·4	97·1	105·6	109·2
33·46	30·02	89·7	101·7	120·1	98·2	95·1	84·3	80·3	88·5	88·2
41·42	37·02	89·4	101·5	100·9	106·2	100·8	90·3	78·0	89·6	89·8
35·71	30·37	85·0	99·9	97·7	105·5	98·1	85·6	73·1	92·1	72·0
44·17	36·06	81·6	97·2	97·6	98·8	88·7	86·6	84·9	94·7	94·1
40·27	32·88	81·6	106·7	110·5	91·3	84·9	81·5	77·9	87·2	95·6
43·40	34·66	79·9	83·8	68·8	92·7	89·8	65·7	69·5	77·3	80·7
42·79	32·96	77·0	93·7	90·0	100·5	89·4	85·3	65·4	83·4	84·1
27·95	20·95	75·0	87·8	68·5	99·2	91·5	65·3	68·4	83·1	80·0
48·79	31·33	64·2	83·4	75·5	104·0	85·8	63·8	66·0	81·4	75·2
22·45	9·37	41·8	69·5	40·3	86·4	51·8	33·8	32·3	58·0	56·1
20·71	8·18	39·5	70·0	51·1	83·9	45·8	35·3	31·9	47·7	57·4

The yields of the two years together are taken on which to base the above percentages, since the residual effect was often clearly visible in the second year, even where the slag was applied in both years.

The increased yields of dry matter in the crops and the increased phosphoric acid taken up by the crops are compared with the "citric solubility" in the accompanying diagrams.



——— Citric Solubility.
.... Increased Yield of Dry Matter.
- - - - - - Increase in P_2O_5 taken up.
Results at Bremen Station with different Soils shown graphically.

It is evident that the effect of the slags differed widely with the different soils. With the *sandy soil*, had the figures and diagrams for the two years been given separately, they would have shown hardly any connection in 1911 between citric solubility and manurial effect. This was due to the fact that the soil approached pure sand very closely in composition, and it was somewhat futile using this soil for an experiment of this nature. The biological and chemical factors influencing the availability of basic slag in cultivated soils played no part here, and the absorptive capacity of the plant roots was so weak that fineness of grinding and lime content were the controlling factors. There was a somewhat closer connection between the sets of figures obtained in 1912 on the sandy soil, organic substances being supplied by the oat and mustard residues and the co-operation of soil factors thus being obtained

The *moor soils* had been long in cultivation and offered good opportunities for the slag. Considering the chances of experimental error the diagram shows a quite satisfactory parallel between citric solubility and manurial value.

The attempt was made in the third experiment to bring the sand more into line with a cultivated soil; on the whole the experiment may be said to have succeeded, the parallel in the case of both single and double dressings of slag being quite satisfactory.

The conclusions drawn from these experiments were that the "citric solubility" of basic slag is little, if at all, related to manurial value on soils of almost pure sand, but that the very *satisfactory parallel between citric solubility and manurial* value on cultivated soils justifies this method of evaluation of basic slag, provided that the fineness does not fall below certain limits (70 per cent.).

Bromberg.—The soil used was a loam very much in need of phosphoric acid. Each separate part of the experiment was repeated five times and the average of the five pots taken. The crops grown were barley followed by mustard in 1912 and oats followed by mustard in 1913. The basic slag was applied (with other manures) before the first crop (barley) only; besides the ordinary dressing, double and treble dressings were given.

The relation between citric solubility and manurial value was shown most clearly with the crop of barley. The following figures show the *increase* in dry matter (grain and straw):—

Barley.

Increase in Dry Matter.

Total Phosphate of Lime.	Citric Soluble Phosphate of Lime.	Citric Solubility.	Ordinary Dressing of total P_2O_5	Double Dressing of total P_2O_5.	Treble Dressing of total P_2O_5.
Per cent.	Per cent.	Per cent.	grm.	grm.	grm.
21·10	7·67	36	60	110	164
22·19	9·17	41	54	128	171
49·92	30·30	61	96	149	211
28·10	19·84	71	115	166	230
35·64	29·78	83	123	195	254
45·74	39·81	87	104	190	231
37·04	35·43	96	154	247	282

The parallel between the two sets of figures was quite satisfactory with regard to the residual effect on the first year's crop of mustard, viz.:—

Mustard.
Increase in Dry Matter.

Total Phosphate of Lime.	Citric Soluble Phosphate of Lime.	Citric Solubility.	Ordinary Dressing of total P_2O_5.	Double Dressing of total P_2O_5.	Treble Dressing of total. P_2O_5.
Per cent.	Per cent.	Per cent.	grm.	grm.	grm.
21·10	7·67	36	36	65	119
22·19	9·17	41	41	73	127
49·92	30·30	61	71	133	154
28·10	19·84	71	89	156	187
35·64	29·78	83	77	147	205
45·74	39·81	87	86	155	203
37·04	35·43	96	76	167	187

The further residual effects on the 1913 crop of oats were quite satisfactory from the point of view of variation according to citric solubility. The residual effects were far less important with the last crop of mustard.

In the following table the effect of the one application of basic slag on the whole four crops is shown :—

Barley, Mustard, Oats, Mustard
Increase in Dry Matter.

Total Phosphate of Lime.	Citric Soluble Phosphate of Lime.	Citric Solubility.	Ordinary Dressing of total P_2O_5.	Double Dressing of total P_2O_5.	Treble Dressing of total P_2O_5.
Per cent.	Per cent.	Per cent.	grm.	grm.	grm.
21·10	7·67	36	159	289	444
22·19	9·17	41	141	317	500
49·92	30·30	61	246	438	573
28·10	19·84	71	300	509	575
35·64	29·78	83	284	508	666
45·74	39·81	87	247	520	638
37·04	35·43	96	331	557	683

The connection shown in the above table between citric solubility and manurial value is considered quite satisfactory.

It will be seen that the best sample of slag was 2·7 times as "soluble" as the worst. The increases in crop correspond very closely with this figure, viz. :—

	Barley.	*Whole four crops.*
Ordinary Dressing	2·6 times ..	2·3 times
Double Dressing	2·2 „ ..	1·9 „
Treble Dressing	1·7 „ ..	1·5 „

The smaller the dressing, the closer was the connection ; the smallest dressing given here was much larger than would be the case in field work in practice.

The phosphoric acid content of the dry matter for all crops, all slags, and all dressings, was ascertained. The following table shows the *increased* phosphoric acid content of the crops (over the non-phosphoric acid pots) expressed as percentages of the total phosphoric acid given :—

Citric Solubility.	Barley.			Whole four crops.		
	Ordinary Dressing.	Double Dressing.	Treble Dressing.	Ordinary Dressing.	Double Dressing.	Treble Dressing.
36	17	13	11	50	47	43
41	14	14	11	40	46	49
61	21	15	15	71	59	56
71	24	16	14	89	75	53
83	27	19	15	92	82	66
87	22	20	17	68	82	67
96	34	26	23	88	82	72

The conclusion drawn from the Bromberg experiments is that the manurial effect, and therefore the value, of basic slag

Citric Solubility.		Increase in Dry Matter.			P_2O_5 taken by Crops from the Slags.		
No. of Slags.	Per cent.	1st year grm.	2nd year grm.	total grm.	1st year grm.	2nd year grm.	total grm.
		Same quantities of *Total* P_2O_5.					
4	98–86 (*a*)	17·0	27·0	*44·0*	0·075	0·064	0·139
5	84–77 (*b*)	15·0	25·3	*40·3*	0·060	0·055	0·116
2	71–62 (*c*)	15·4	18·6	*34·0*	0·068	0·035	0·103
2	42–35 (*d*)	12·6	9·4	*21·9*	0·051	0·015	0·066
		Same quantities of *Citric Soluble* P_2O_5.					
4	98–86 (*a*)	16·4	24·2	*40·6*	0·080	0·057	0·138
5	84–77 (*b*)	14·9	25·7	*40·6*	0·065	0·058	0·124
2	71–62 (*c*)	15·5	25·9	*41·4*	0·073	0·066	0·139
2	42–35 (*d*)	16·4	25·8	*42·2*	0·086	0·067	0·153

(*a*) (*b*) (*c*) (*d*) The analyses of the slags were as follows (per cent.) :—

	(*a*)				(*b*)				
Total Phosphate of Lime	21·89	36·58	40·72	33·57	34·95	39·92	44·04	43·43	41·81
Citric Soluble Phosphate of Lime	21·43	35·38	35·49	28·78	29·32	32·09	35·16	33·94	32·13

	(*c*)		(*d*)	
Total Phosphate of Lime	27·75	47·36	22·45	20·67
Citric Soluble Phosphate of Lime ..	19·75	30·37	9·16	7·30

does not depend on its content of total phosphoric acid alone, but is also strongly influenced by its solubility, so that its behaviour towards a 2 per cent. solution of citric acid must be accepted as a measure of its value.

Halle.—The soil under experiment was 90 per cent. sand, 10 per cent. loam. In one set of experiments rye grass was

grown in 1911 and 1912; in another set oats were grown in 1911, mustard in 1912 and oats in 1913. In each case, and with each slag, two dressings of phosphate were given, the dressings supplying the same amounts of (1) total phosphoric acid, and (2) citric soluble phosphoric acid.

Thirteen slags were tested. The results from the two-year experiment are shown in the second table on p. 546, in which slags of similar solubility are grouped together. This table shows the crop to vary closely with the citric soluble phosphoric acid and to be unconnected with the total phosphoric acid supplied.

The connection between citric solubility and manurial effect was not so close in the second experiment as in the first; only a small proportion of the phosphoric acid supplied was used by the crops and the experiment would have to be carried on further to bring out more clearly the difference between the slags. The results may, however, be given:—

Citric Solubility.		Same quantities of *Total* P_2O_5.		Same quantities of *Citric Soluble* P_2O_5.	
No. of Slags.	Per cent.	Increase in dry matter over the three years.	P_2O_5 taken by the crops from the slags over the three years.	Increase in dry matter over the three years.	P_2O_5 taken by the crops from the slags over the three years.
		grm.	grm.	grm.	grm.
4	98—86 (*a*)	22·4	0·060	24·7	0·076
5	84—77 (*b*)	19·6	0·047	21·3	0·066
2	71—62 (*c*)	18·7	0·050	23·0	0·066
2	42—35 (*d*)	10·3	0·024	22·1	0·067

(*a*) (*b*) (*c*) (*d*)—See footnote to previous table.

Even so far as this latter experiment has gone the connection has been shown between the increase of crop (especially the phosphoric acid taken up) and the citric soluble phosphoric acid supplied.

In connection with the experiments at Halle it is interesting to compare fineness and alkalinity with the crop results.

Fineness.	Alkalinity (reckoned as CaO).	Total Increase in Dry Matter.	
		Same quantity of total P_2O_5.	Same quantity of Citric Soluble P_2O_5.
Per cent.	Per cent.	grm.	grm.
70·0	33·2	42·0	40·2
88.8	31·6	42·6	44·1
84·2	22·5	36·7	39·2
92·9	21·6	34·9	41·4
93·8	24·2	33·1	41·3
93·7	27·2	21·1	42·4

The conclusion is drawn that there is no connection between yields of crop and either fineness or alkalinity of the slags, so far as the conditions under which these experiments were carried out are concerned; but that, on the other hand, there may be said to be a *general* connection between yields and citric solubility.

Harleshausen.—From the point of view of demonstrating any connection between manurial value and citric solubility the experiments at Harleshausen were frankly a failure. The experimenter (E. Hazelhoff) ascribes this to peculiarities in the soils under experiment (sand and loam). Only four slags were, however, tried. And while no connection between citric solubility and yields could be shown, the total phosphoric acid content of the slags proved no better index.

Mockern.—Of the slags supplied, five were chosen with very varying phosphoric acid content. The soils were sands: (1) a quartz, (2) a sand with a small content of lime and with no humus. The crops were barley and peas.

There were two series on the first soil according to whether, in addition to other manuring, the soil received lime or gypsum.

Total Phosphate of Lime.	Citric Soluble Phosphate of Lime.	Citric Solubility.	Soil 1. Total Dry Matter.		Soil 1. P_2O_5 taken from the slags.		Soil 2. Total Dry Matter.	Soil 2. P_2O_5 taken from the slags.
			Lime Pots.	Gypsum Pots.	Lime Pots.	Gypsum Pots.		
22·78	22·80	100·00	100·0	100·0	100·0	100·0	100·0	100·0
36·93	36·21	98·05	96·8	99·7	109·7	100·0	105·3	94·5
42·68	39·22	91·87	94·5	99·8	84·8	84·3	99·8	97·7
48·79	31·33	64·20	92·7	93·4	72·8	79·7	91·1	72·7
20·71	8·18	39·47	65·7	67·2	40·4	43·8	46·2	24·2

The above table shows the percentage results obtained from applications of the same amounts of total phosphoric acid.

A consideration of the total dry matter produced shows that the citric solubility is a much better indication of the manurial effect than the total phosphoric acid content of the slags. It is explained that the manurial effect of the phosphoric acid of different slags varies (within certain limits) according to soil and crop, but principally according to cultivation and experimental conditions; and that this circumstance must be considered in obtaining a measure of value and proving the worth of the same. An absolute measure of value can be obtained by neither pot nor field experiments; further, when the aim is to compare manurial values by pot experiments the question

is less one of manurial effect than of the utilisation of the particular manure.

The latter point is brought out in the above table in the columns showing the phosphoric acid in the dry matter, *i.e.*, the phosphoric acid taken from the different slags. These figures show a very good agreement between citric solubility and the phosphoric acid taken up in the crop.

The conclusion drawn from the Möckern experiments is that while they are too small in number to allow a definite decision to be arrived at as to the value of the citric solubility test, the results justify current conclusions that there is no ground for departing from this test.

EXPERIMENTS ON THE PREPARATION OF HOME-MADE RENNET.*

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Owing to circumstances connected with the war, the supply of rennet has become somewhat restricted, and prices have advanced considerably. With a view, therefore, to placing cheese-makers in a more independent position, an attempt is being made to devise a method for the preparation of home-made rennet by utilising vells which can be obtained from home-slaughtered calves. Such a method must necessarily be simple, and must result in an extract which is of sufficient strength and reliability to make its production profitable. It is thought that the extract which we have prepared by the method about to be described fulfils these conditions and is much cheaper than the commercial rennet.

Experiments were carried out on several batches of both fresh and dried vells; but the latter, although obtained from the best sources, were in all cases of such poor quality that the extract from them was of no practical value.

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* An article containing practical instructions for the preparation of home-made rennet, and based on the experiments here described, was published in this *Journal* for August, 1916, p. 459.

The following method of testing the extract was adhered to throughout the whole course of the experiments: To one drachm ($3\frac{1}{2}$ c.c.) of the rennet extract 4 oz. of milk of known acidity at a temperature of 84° F. were added. The whole was stirred continuously with the thermometer for thirty seconds, and at intervals until the coagulation point was reached. This was indicated by the addition of a few pieces of cut straw, which stopped rotating at the moment of coagulation. The acidity of the milk was determined by the acidimeter.

The following is an account of the experiments:—

Dried Vells.—*First Batch.*—These vells were full of mites and apparently very old. In each of twelve stone jars a quart of brine was placed. To three of these a single whole vell was added; to three, single vells which had been cut into strips about $\frac{1}{2}$ in. wide; to three, single vells which had been cut very finely into pieces about $\frac{1}{4}$ in. square; and to the remaining three, single vells which had been cut into $\frac{1}{2}$ in. squares and then ground in a mortar with a portion of the brine and sand. The brine in all cases was made in the following way: To 1 gal. of distilled water 2 lb. of salt and 1 oz. of saltpetre were added; the whole was boiled for half an hour and allowed to cool before using. The jars were then placed in a cool, dark cupboard. Each set was stirred with a Scotch hand half an hour before testing, and again after the test had been made, and each jar was covered down with parchment paper.

The extract obtainable from these vells after steeping in brine for six weeks was so extremely weak that it would be quite useless to a cheese-maker.

Second Batch.—These vells were smaller than those of batch 1, but otherwise presented a similar appearance. A quart of brine was placed in each of six jars. Two whole vells were placed in each of two jars. In each of two other jars, two vells cut into $\frac{1}{2}$-in. strips were placed, and to the remaining two, two vells cut into very small pieces about $\frac{1}{4}$ in. square were added. The extracts were stirred half an hour before and also after testing, and the jars were placed in a cool, dark cupboard.

For the production of rennet by these methods, these vells proved quite useless.

Third Batch.—These vells (24) presented a somewhat better appearance than either of the batches previously dealt with. They were dried and salted but not flattened, and were tied with string at both ends. The end portions were cut off

just inside the string, leaving only the fourth stomach for experimental extraction.

Eight whole vells were taken and four were placed in ½ gal. of brine, made as previously described. The other four were placed in ½ gal. of brine to which 90 grammes of boric acid were added.

Another eight vells were cut into strips about ½ in. wide, four being placed in ½ gal. of brine without boric acid, and the remaining four in ½ gal. of brine to which 90 grammes of boric acid were added.

The remaining eight vells were cut into very small pieces about ¼ in. square; and four were added to ½ gal. of brine, and the others to ½ gal. of brine and 90 grammes of boric acid.

The coagulating properties of the extracts from these vells were more satisfactory than in the case of those from either batches 1 or 2, but at the end of sixteen days the maximum amount of the enzyme seems to have been extracted as, on making further tests thirteen days later, the quality had not improved. Although the vells were quite the best of any dried ones used in these experiments, the extracts were too weak to be of much practical value.

Fresh Vells.—*First Batch.*—These were apparently derived from calves of from three to four months old, since in every case the contents of the stomach were grass and solid food, showing no evidence of milk feeding. The vells were cut open, emptied, and washed in cold water. They were then divided into two sets of ten each (A and B), and to each set, placed in an enamel bucket, 1 gal. of brine was added. Four days later the extract from one batch, B, was found to give a rennet test of 1 min. 40 sec., and the other, A, of 3 min. 35 sec. Even after this short period of four days, the extract from B was stronger than ordinary home-made rennet, and this in spite of the fact that the vells were obviously not taken from calves of from five to ten days old, as is usually recommended.

At the end of this time (four days), both batches had developed a certain amount of sliminess, and it was considered advisable to place the vells in a second steeping of brine.

As a preliminary to filtration, the brine and vells were poured on to two thicknesses of muslin, tied up and allowed to drip for about five hours. The bundles were then squeezed by hand, the vells removed from the muslin cloths, and each batch of ten placed in the second steeping of 1 gal. of brine.

The first extracts (A and B) were each further divided into two halves, and to a half of each 50 grammes of boric

acid were added (called Ap and Bp) while the other halves were allowed to remain without preservative (called A and B). Before attempting filtration, samples of all four solutions were withdrawn for rennet tests. The coagulation in three cases was a little more rapid than it had been on the previous day.

Methods of Filtration.—Extract B was passed through a cotton wool filter prepared in the following manner: A glass funnel, preferably not less than 6 in. in diameter is taken, and a piece of absorbent wool large enough to cover the hole is placed in the bottom. A long strip of cotton wool is then taken and placed round the inside of the funnel; it is well damped and pressed down so that the whole inside surface of the funnel is well covered with a layer of cotton wool. To make this filter more rapid, a smaller glass funnel may be dropped inside the bigger one before placing the cotton wool in position. Filtration through cotton wool begins rather quickly but gradually becomes much slower. It seems, however, to be the simplest and most efficient method for this work. Extract B after filtration was translucent but had a reddish appearance.

Extract A was filtered through:—

(1) Cotton wool only. Its appearance was similar to B.

(2) Through cotton wool covered with a layer of granulated charcoal. The colour was still reddish, but not quite so marked as in 1.

(3) Through cotton wool and fine washed sand. The appearance was similar to 2.

(4) Through cotton wool and powdered charcoal. Two filters of this type were made with different amounts of powdered charcoal. The solution from that with a thick layer came through colourless, and it was found in this case that the enzyme had been largely absorbed by the charcoal, since coagulation of the milk did not take place in seven minutes when this extract was tested.

(5) Through a filter paper with a layer of Kieselguhr on a Buchner funnel—a filter pump is needed to effect filtration by this method.

Solution Ap was filtered through cotton wool only. A portion was stirred before filtration and a portion was left unstirred. The results show that it is best to mix the solution thoroughly before filtering.

Solution Bp was filtered through (1) cotton wool only, (2) cotton wool and sand, (3) cotton wool and granulated charcoal, (4) cotton wool and powdered charcoal.

These experiments demonstrated two facts. First, that with one exception already mentioned (a thick layer of powdered charcoal), the various methods of filtration produced no deleterious effect upon the enzyme, as shown by the time taken to produce coagulation. Second, that rennet made by the method outlined above, and with a suitable amount of preservative added, can be kept for periods of time of not less than six weeks, and at the end of that time shows no diminution of strength. Those solutions to which no preservative had been added were discarded on the 12th July (having been put in brine on the 9th June), as by this time (with one exception) they were markedly cloudy and showed evidence of the presence of gas-forming organisms.

Since the addition of sand, powdered charcoal, or granulated charcoal did not seem to have improved either the keeping or coagulating properties of the extracts, all later filtrations were made through cotton wool only.

Cheese-making Experiments.—Several of these solutions have been used in the making of Wensleydale cheese, viz. :—

17th July, 1916. *Bp. Filtered through cotton wool only.*—To 10 gal. of milk, at a temperature of 85° F., 10 drachms of extract were added. The curd was ready for cutting in about two hours, this being slightly longer than the normal time for Wensleydale cheeses, but the coagulum was firm and the curd worked normally at the later stages.

18th July, 1916. *Ap. Filtered through cotton wool only.*—To 10 gal. of milk, 12 drachms of extract were added. The curd was ready for cutting in about two hours. As this extract was known to be somewhat weaker than Bp. it was not surprising that the extra amount of rennet did not hasten the time of coagulation.

20th July, 1916. *Bp. Filtered through cotton wool and powdered charcoal.*—To 10 gal. of milk 12 drachms of extract were added. The curd was ready for cutting in an hour and a half, but at the later stages was found to be somewhat soft.

21st July, 1916. *Bp. Filtered through cotton wool and granulated charcoal.*—To 10 gal. of milk 12 drachms of extract were added. The curd was ready for cutting in 1 hr. 50 mins., and was normal at the later stages.

Further examination of these cheeses will be made in order to determine if the rennet extracts used have exerted any effects during the process of ripening.

First Batch of Fresh Vells in Second Steeping of Brine.—The extract obtained from this second steeping was quite satis-

factory, although slightly weaker than the first extract, and produced a good coagulum. The vells were taken out of the second lot of brine after about five weeks. The main bulk of the extract was poured through cheese cloths, and as much as possible of the liquid remaining in the vells was pressed out by means of a root press. To one half, 50 grammes of boric acid were added. To the other half, 90 grammes were added. As far as is known at present, these large quantities of preservative do not seem to have affected the coagulating powers of the extract, but these solutions are being kept for further tests. After the addition of the boric acid, and before storing, these extracts were poured several times through cotton-wool filters.

Second Batch of Fresh Vells.—These were obviously the stomachs of young milk-fed calves, and were twenty in number. The skins were trimmed and well washed with cold water after splitting and emptying. Two separate gallons of brine were used, to one of which 60 grammes of boric acid were added. Each vell was cut into four pieces and these were equally divided between the 2 gal. of brine, that is to say, two portions of each vell were placed in the gallon of brine without boric acid, and the remaining two in the gallon of brine with boric acid.

Although these vells were much younger than the fresh ones previously dealt with, it required a much longer period of time for their extract to attain the same strength; but after three weeks' steeping the rennet was sufficiently strong to give a satisfactory rennet test. After this time, the solutions and vells were poured on to cheese cloths, the vells tied up in the cloths, and the bundles squeezed by hand and allowed to drip for several hours. The vells were then removed from the cloths and as much as possible of the remaining liquid was pressed out in a root press, and filtered several times through cotton wool. Rennet tests were again made and were found to be satisfactory.

The vells were replaced in two half-gallons of brine, one with, and one without, boric acid, and the first extract and the second steeping are being kept for further experiments.

Summary of Results.—The experiments carried out on the dried vells showed that there was no advantage in cutting them up into strips or smaller pieces, as in every case the whole vells produced a rennet of as good coagulating properties as in the case of those which had been cut up. Moreover, the dried vells were of very poor quality and produced a very weak rennet.

The fresh vells, on the other hand, gave a much more reliable extract with stronger coagulating properties.

When using fresh vells it does not seem to be essential that the fourth stomach of very young milk-fed calves should be used, since the stomachs of older calves can produce a useful extract. Whether this extract would be of the same average quality as that from younger calves is not yet known. The question whether its coagulating properties are due to pepsin or rennet does not appear to be of great importance, since Todd, working at the Midland Agricultural and Dairy College, demonstrated some years ago that pepsin could quite well be used as a substitute for rennet, and, recently, similar work in America has produced the same results.

With the addition of a preservative, this rennet kept in good condition for six weeks, and was then still active. When used for cheese-making, in about double the quantity of commercial extract, it gave a very good firm curd in a reasonable time.

The method of making is simple. It does not necessitate an expensive plant, nor does the process take up much time.

The cost of production is low, being about 6*s*. a gal., since vells can now be procured for about 6*d*. each, and ten vells produce nearly 1 gal. of extract. The present price of commercial rennet is about 28*s*. a gal.

THE POSSIBILITIES OF INCREASED CROP PRODUCTION.

IN his presidential address on 6th September, at Newcastle, to the Agricultural Section of the British Association, Dr. E. J. Russell took as his subject the possibilities and prospects of increased crop production. He began by remarking that we have seen how, in time of war, the supply of food might easily become the factor determining the issue, and that it is already clear that in time of peace a vigorous rural civilisation is indispensable to the stability of the social structure of the nation.

At the outset a brief historical sketch was given of the development of agricultural methods in this country, and the point was made that this development is a slow and steady growth; the three great lines of progress have been: (*a*) the introduction, usually from Flanders, of crops that had not previously been grown on British farms, (*b*) the removal of obstacles which prevented crops from making as full growth as they might, and (*c*) the introduction of new methods for increasing the growth of the plant.

The body of the address was devoted to a consideration of the means of (i) increasing the yields per acre, and (ii) reducing the cost per acre and increasing the certainty of production.

Increased Yields per Acre.—The main obstacles to increased plant-growth lie in the climate and in the soil. Climate apparently cannot be altered ; we have to adapt ourselves to it by growing crops and varieties suiting the conditions that happen to obtain. Soil can be altered, and it is possible to do a good deal in the way of changing it to suit the crops that are wanted

Light soils, clays and loams were each considered by Dr. Russell.

On light soil the two great obstacles to be overcome are the lack of water and the poverty in plant nutrients. The problem can be dealt with by increasing the depth of soil through which the roots can range, or by adding the necessary colloidal substances—clay, marl, or organic matter. As regards depth of soil, where a thin layer of rock separates the top soil of sand from a great depth of sand below, improvement can be effected by removing the rock—a cheap method being possibly the use of the high explosives available at the end of the war ; to prevent reforming of the rock occasional deep ploughing must be carried out. The process of adding marl to sand has disappeared in England on account of transit difficulties ; the usual methods are to add organic matter either by dressings of farmyard manure, by feeding crops to sheep on the land, or by ploughing crops and crop residues straight into the soil ; the addition of organic matter must generally be accompanied by the addition of lime or limestone (otherwise the soil may become sour) and all the plant nutrients—nitrogen, potash and phosphates—as well as by constant cultivation to keep down weeds and retain soil moisture. When all this is done, light soils become very productive ; they will grow almost any crops, and they can be cultivated easily and at almost (but not quite) any time. On account of the costs of the above processes crops must be grown which bring in a high money return—potatoes, greens, peas, sugar-beet, or two crops in a season—although the money-finding crop need not be taken very often. The best hope for improvement of light soils lies in increasing the number of money-finding crops, improving the methods of growing them and the relation to the other crops or the live stock, and improving the organisation for disposing of them, so that farmers will feel justified in spending the rather considerable

sums of money without which these light soils cannot be successfully managed.

Heavy land can be improved by liming or chalking followed by drainage. Mole drainage promises to be an efficient and much cheaper substitute for the old system of draining, but co-ordination and a certain amount of control over the whole drainage area is needed, it being undesirable that a great fundamental improvement should be at the mercy of individuals. The cultivation of clay land is always risky, however, as it is suited only to a limited number of crops, and is difficult to cultivate, and hence most men lay down this land to permanent grass. The risk can be reduced:

(*a*) By quicker ploughing in autumn so as to bring the work well forward; this seems only possible by the use of the motor plough. Dr. Russell believes that motor ploughs and cultivating implements will play a considerable part in the improvement of heavy land.

(*b*) By keeping up the supplies of organic matter in the soil; the simplest plan seems to be the adoption of the North Country system, in which the land is alternately in grass and in tillage. Dr. Russell thinks that demonstrations on such lines in heavy-land districts would resolve many of the farmers' doubts as to the advisability of breaking up some of their grass land.

There will always be some grass on the clays and this must be improved—in most cases by basic slag—with possibly further treatment of the improved herbage.

Loams present no special difficulties. The crop may be hampered by lack of root room, in which case periodical deep ploughing or subsoiling may bring about a substantial improvement; sub-soiling at Rothamsted at a cost of about £1 per acre was followed by an increased yield per acre of 10 cwt. of potatoes, worth 35s.

All the above soils can next be further improved by proper treatment with fertilisers. There comes a point, however, where further increases in fertiliser dressings cease to be effective because the plant cannot grow any bigger, or it cannot stand up any longer, or its resistance to disease is weakened; here, therefore, new varieties must be found that can grow bigger or stand up better or are more resistant to disease. Dr. Russell anticipates considerable improvements from a closer co-ordination of crop variety and soil and climatic conditions.

Reduction of Cost per Acre and Increase of Certainty of Production.—One of the most hopeful ways of attacking this problem

is to increase the efficiency of the manurial treatment; the whole of the fertilising constituents applied to the soil are never recovered in the crops, but by arranging a proper rotation, and by using a properly balanced manure the loss can be much reduced. As regards this latter point Dr. Russell pleads for agreement between the county authorities as to a uniform scheme after the War in their manurial experiments.

Economy is also possible in the management of farmyard manure * the production of which is estimated at 37 million tons annually, valued at £9,250,000, compared with an annual consumption of £6,500,000 worth of artificials.

Further saving is possible in the soil itself; where there is no crop there is a loss of valuable nitrates over the winter,† the heaviest loss occurring on the best manured land. This emphasises the need for spring dressings of quick-acting nitrogenous manures, and accounts for the marked improvements that set in on many soils when spring dressings are given. A good way of getting round the difficulty is to sow a catch crop in autumn and either to plough it in before the main crop is sown or to feed it to stock, whichever is more convenient. Wibberley has discussed several schemes of continuous cropping [see Special Leaflet No. 65] which give a succession of crops which cover the land at the critical time when losses occur. Our implement makers are steadily increasing the number and effectiveness of the implements for the purpose, while motor traction promises also to increase the speed of working.

Dr. Russell's experiments indicate two difficulties in continuous cropping: the first is that a fallow seems to have an effect on the soil nothing else can quite produce, and the second is that the more intensive the cropping, the greater is the opportunity for the various pests to live, and bacterial efficiency falls off, leading finally to soil sickness. Dr. Russell, however, thinks that these difficulties ought not to be beyond control. In glasshouses the sickness problem has been solved by sterilisation.

Besides the methods of increasing the efficiency of the manurial scheme (discussed above) the loss of manurial ingredients from arable land may be met by leaving the land in grass for a few years so that the gain in nitrogen during this period may balance the loss during the arable period; this is

* The prevention of loss from manure heaps was dealt with in an article by Dr. Russell and Mr. E. H. Richards, in this *Journal* for Dec., 1914, p. 800.

† This was dealt with by Dr. Russell and Mr. A. Appleyard in this *Journal* for April, 1916, p. 22.

already done in several rotations, but it suffers from the disadvantage that the land during its recuperative grass period is producing less than during the arable period.

Dr. Russell next dealt with the improvement possible in cultivation which will result from the use of the motor plough or tractor, enabling the farmer to plough just as much as he likes in autumn, or, if he wishes, to get in a bastard fallow or catch crop; and alluded finally to economy in the choice of crops. The need for accounts was emphasised as enabling unprofitable crops to be replaced by profitable. Swedes, *e.g.*, are invariably grown at a loss at Rothamsted, and Dr. Russell believes this would be found not uncommon in the south of England.

The survey of the methods of increasing crop production was concluded by a reference to the need to raise, by educational methods, the ordinary farmer to the level of the good one, to the need for extending the area of land under cultivation by the reclamation of wastes and to the need for the substitution of arable for grass. On this point Dr. Russell cited Mr. Middleton's recent pamphlet on the productivity of cultivated land in Germany*; and he stated that the problem was essentially that of the distribution of risk, since a farmer does not know what returns he will get when he prepares his land for its next crop and so must leave a balance for safety.

Lastly, there is a factor which operates against increased crop production which Dr. Russell thinks it unreasonable to hope to see entirely abolished, and that is that a farmer has to get his pleasure out of the countryside as well as find his work in it, so that trees, hedges and copses are left, pheasants bred, foxes and hares preserved, and rabbits spared. "It would be wholly unreasonable to expect the farmer to lead a life of blameless crop-production unrelieved by any pleasure, and it would be social folly of the highest order to make the young farmer exchange the innocent pleasure of an occasional day's shooting or hunting in the country for the night's pleasure in town. . . . I think we shall always have to be content with getting less crop-yields than the land might produce because we must always keep up the amenities and the pleasures of the countryside. We must maintain the best equilibrium we can between these somewhat—but not wholly—conflicting interests."

"When we know more about the soil, the animal, the plant, etc., we shall be able to increase our crop-yields, but we shall lose the best of our work if we put the crop-yield first. Our

* Reviewed in this *Journal* for August, 1916, p. 426.

aim should be to gain knowledge that will form the basis of a true rural education, so that we may train up a race of men and women who are alive to the beauties and the manifold interest of the countryside, and who can find there the satisfaction of their intellectual as well as their material wants. If we can succeed in that, we shall hear far less of rural depopulation; instead we may hope for the extension of that type of keen healthy countryman which has always been found among the squires, farmers, and labourers of this country, and which we believe was already increasing before the War. With such men and women we can look forward with full confidence to the future."

BASIC SLAG.

As a cheap and effective agent in the improvement of much of the poor grass land, the use of basic slag merits greater attention, especially in view of the possibility of increasing the area under tillage in the future. The improvement effected by the slag is to be measured not only by the immediate results, such as the increase of herbage, or of meat or milk, but also by marked increase in the fertility of the soil lasting over a period of years. An application of from 5 to 10 cwt. of basic slag per acre entails little labour, and although there may be some delay at present in obtaining supplies, owing to congestion on the railways, this difficulty can be largely surmounted by foresight in ordering.

Basic slag, as is well known, owes its value to the fact that it contains phosphate of lime in a more or less readily available condition. It usually contains also a considerable proportion of lime capable of neutralising acids in the soil, though probably not more than 2 to 5 per cent. is in the form of "free" or "caustic" lime. Obviously, then, the first thing to be ascertained in buying basic slag is the percentage of phosphate of lime which it contains. Furthermore, the availability of the phosphate in different samples varies. As a rough guide to determine whether the phosphate is likely to become "available" or useful to plants in a reasonable time, a method often adopted, and officially recognised under the Fertilisers and Feeding Stuffs Act, is to ascertain the percentage soluble under standard conditions in a 2 per cent. solution of citric acid.

A fuller account of basic slag, with notes on fineness of grinding and the most suitable grade to use, is given in the

Board's leaflet No. 267, but the following notes on its application may usefully be given here :—

Soils.—Basic slag usually gives its most striking result when applied to poor pasture on heavy, clay soil. The results obtained at Cockle Park, and detailed in a supplement to the *Journal of the Board of Agriculture and Fisheries* (January, 1911), are most striking. The effect of slag, is however, by no means confined to poor, clay soils. Excellent results have followed its use on the light soils of the South Downs, and wherever the natural conditions favour the growth of white clover slag is likely to benefit pastures. The alkalinity of the slag renders it also a very suitable manure for peaty and sour soils. Even very light soils deficient in lime sometimes respond well to an application of slag.

Crops.—While basic slag may be regarded as a suitable source of phosphate for all kinds of crops it usually gives best results with those of slow-growing habit. As compared with superphosphate the choice is more a matter of soil than of crop. Basic slag is used in preference to superphosphate when soils are acid and there is danger of cruciferous crops (turnips, etc.) being affected with Finger-and-Toe.*

Time of Application.—When used for a turnip crop basic slag is best applied in the drills in spring, but when used for permanent grass land it is most suitably applied in autumn or early winter, as it is then washed down into the ground before growth starts in the following spring. Generally speaking, October, November, and December are the best months, but January and February are not unsuitable, and there is no fear of loss by drainage or by exposure to the atmosphere whatever be the time at which the manure is applied.

Quantity per Acre.—In ordinary manuring the most economical system is to give repeated applications of comparatively small quantities, rather than large dressings at one particular time. The case of slag applied to grass land, however, is usually different. Basic slag does not act on the grasses of a pasture directly, but indirectly, by first encouraging a strong growth of white clover and leguminous plants, which in their turn enrich and improve the soil in different ways. This growth of white clover is most readily brought about when the pasture is in a poor, unimproved

* See Leaflet No. 17 (*Finger-and-Toe in Turnips*).

condition, as then the clover has room to develop, and meets with comparatively little competition. The aim should, therefore, be to get the maximum growth of white clover at once, and it is advisable to try a comparatively large dressing of slag (say, from 7 to 10 cwt. per acre, according to quality) at the outset, rather than a moderate quantity of 3 to 5 cwt. with the intention of repeating the dressing in two or three years. Surprise is frequently expressed at the development of white clover; very often there is apparently none at all in the unimproved pasture. The explanation is that plants are usually present, but as they are very small and dwarfed by unfavourable conditions they are quite concealed from casual notice by a coarse growth of bent or other grass. Occasionally, however, it may happen that there are none of these small, suppressed plants present, in which case the slag cannot exert its effect. Such a case is rare, but if it does occur, a little wild white clover* seed should be sown in the spring following the application of the manure; a lb. or two per acre would be sufficient, and to give it a chance of germination it should be sown fairly early, and the ground thoroughly harrowed before sowing, and well rolled afterwards.

It is suggested that a heavy dressing, the effect of which might be expected to last some considerable time, is better than repeated applications of small quantities, but it does not follow that when the effect of the first application is beginning to disappear a second application would not prove profitable and desirable; in many cases where a second application has been given after five or six years, the effects have been very good and profitable, though naturally not so striking as those attending the first manuring.

While basic slag usually gives excellent results under the conditions indicated above, it is desirable in those cases in which local experience may be lacking to treat a small area and test the value of the manure, before purchasing large quantities.

Danger to Stock.—The idea is sometimes entertained that basic slag, if taken even in small quantities, may be highly injurious to stock; it may, therefore, be observed that there is practically no danger of special injury resulting from the consumption of small quantities. Care should be taken,

* Articles on Wild White Clover appeared in this *Journal* for December, 1909, and February, 1916.

however, to distribute the slag evenly, and it is advisable to wait until a heavy shower has washed most of the slag off the herbage before turning stock into the pasture.

On light soils, in addition to trying the effect of slag alone, it is also advisable to test the effect of adding kainit, when available, at the rate of 3 or 4 cwt. per acre. Potash is seldom required on heavy clays, but may be needed just as much as phosphate on light soils. On the poor pastures on which slag proves effective, nitrogenous manuring, either in the form of dung, nitrate of soda, or even cake feeding, seldom does good and often does harm. The improvement of such pastures is best effected by encouraging white clover; direct application of nitrogenous manure tends to help the grass to suppress what little clover is present.

CHICKEN REARING AT MORDEN HALL, 1914—15.

THE demonstrations on the rearing of chickens for table purposes carried out by Mr. Paynter were brought to a close in the autumn of 1915. The work extended over three seasons and was conducted at Haslington Hall, near Crewe, during 1912–13, and at Morden Hall, in Cambridgeshire, during 1913–15. The figures for 1912–13 and 1913–14 have already been published in this *Journal*.* In publishing the figures for 1914–15 it seems desirable to refer once again to the object of Mr. Paynter's work and to summarise and compare the results obtained during the three years.

The object which Mr. Paynter had in view was to produce as economically as possible, by methods applicable to an average small holding and by the use of simple and comparatively inexpensive appliances, about 3,000 table chickens each season. The method followed was to purchase the eggs for hatching and to keep no adult stock on the land. Incubation commenced in December, and continued until the beginning of June, and during this period about 9,000 to 10,000 eggs were incubated. The chickens were reared to the age of 14–16 weeks, or until they scaled from 3½ lb. to 4 lb. They were sold alive and dispatched in weekly consignments, and the last batches were marketed at the end of September or early

* March, 1914, p. 1049; and April, 1915, p. 10.

in October. From the end of October to the beginning of January no stock remained on the holding.

The demonstrations at Haslington Hall, and at Morden Hall in 1913–14, were conducted on these lines; in 1914–15 the plan of the demonstration was slightly modified.

The result of the season's work at Haslington Hall indicated pretty clearly that one of the main difficulties was that of *obtaining adequate supplies of suitable eggs for hatching*, especially in early winter. The percentage of chickens hatched out of the total number of eggs incubated was low, 41 per cent., and this was assumed to be due in part to the fact that almost all the eggs were sent long distances by rail.

The experience of 1912–13 also suggested the desirability of fattening a certain proportion of the chickens in order to compare the return obtained from them with that obtained from the unfatted birds.

In the autumn of 1913 Mr. Paynter transferred his equipment to Morden Hall, and during 1913–14 the demonstration was conducted as in the previous year, except that arrangements were made to fatten a certain proportion of the chickens.

In August, 1914, after the outbreak of war, it was decided as an economic measure to retain about 1,000 of the pullets then in the runs for egg production instead of disposing of them for table purposes. A description of the arrangements made for housing these birds and the figures relating to egg production and sales were published in this *Journal* for July, 1915, p. 331.

The experience of the season 1913–14 as to the percentage of chickens hatched was similar to that of the previous season, despite the fact that higher prices were paid for the eggs in the hope that a more careful selection of the sources of supply might lead to better results. In 1914–15 it was decided to make a further effort to improve these results and to purchase about 100 to 130 stock birds in order that a portion of the eggs for hatching might be produced on the holding. This was a modification of Mr. Paynter's original method and was the only essential change introduced.

The birds selected by Mr. Paynter for stock purposes were of the following breeds:—

Sussex, Faverolles, Silver Grey Dorkings, Concou de Malines, Orpington and Rhode Island Red. From these both pure-bred chickens and some chickens from first crosses were obtained. Suitable stock was somewhat difficult to obtain at the prices which Mr. Paynter was prepared to offer for ordinary pure-bred birds.

The birds were divided into breeding pens and located on fresh grass runs. Various types of houses were selected for the birds with the object of affording the small holder, when visiting the demonstration, an opportunity of seeing different designs and of judging of their suitability for his purposes. Thus, in 1914–15, the demonstration consisted of four sections :—

1. The stock birds.
2. The chicken-rearing section ("lean" section).
3. The laying pullets carried over from 1913–14 and housed in Sussex arks.
4. The fattening section.

The main objects in producing the eggs on the holding were :—

(*a*) To increase the percentage of chickens hatched and reared.

(*b*) To secure a more suitable type of chicken for table purposes.

(*c*) To reduce the cost of the eggs.

The figures for 1914-15 show no improvement in regard to (*a*): the percentage of chickens hatched was the same as in former years and the percentage of chickens reared was considerably lower than before.

These results are contrary to general experience, and the fact that there was no improvement in the percentage of eggs hatched is attributed by Mr. Paynter to disease in the breeding stock. The question of the loss of chickens will be referred to again.

The effect of introducing the stock birds was to reduce the proportion of purchased eggs to 15 per cent. of the total number incubated, and to reduce the cost as compared with purchased eggs from 3*s.* 0½*d.* to 1*s.* 7¾*d.* per doz.,* and the cost of eggs per chicken hatched from 5¾*d.* (the figure for 1913–14) to 4½*d.*

The following table gives the total number of eggs incubated, the percentage of chickens hatched, and the total cost of the eggs for each year :—

Year.	No. of Eggs placed in Incubators.	Chickens hatched.	Cost of Eggs. £ s. d.
1912–13 ..	9,897	41 per cent.	76 16 10
1913–14 ..	10,431	41 „ „	102 12 11
1914–15 ..	10,656	41 „ „	82 1 2

* Including all charges.

TABLE I.—*Statement of Eggs incubated and numbers of Chickens hatched.*

Date.	No. of Hatch.	No. of Eggs.			No. of Eggs broken.	No. of Eggs infertile.	No. not hatched.	Chicks (other than crippled).	No. of chicks crippled.	Cost of Eggs and Chickens.	Percentage hatched (excluding cripples) on total No. of Eggs incubated.	Percentage hatched (excluding cripples) after allowing for broken and infertile Eggs.
		Produced.	Bought.	Total.								
Dec. 7th ..	1	—	104	104	—	16	53	35	—		34	41
„ 14th ..	2	13	140	153	—	40	70	43	—		28	38
„ 21st ..	3	37	122	159	—	32	54	73	—		46	57
„ 30th ..	4	138	128	266	—	32	133	101	—	Cost of Eggs:—	38	43
Jan. 5th ..	5	154	132	286	—	36	100	141	—	Bought .. £20 14 11	50	56
„ 12th ..	6	136	150	286	—	28	115	143	—	Produced .. 61 6 3	50	55
„ 18th ..	7	268	159	427	—	48	196	183	—		43	48
„ 26th ..	8	360	192	552	—	76	220	256	—	Total .. £82 1 2	46	54
Feb. 1st ..	9	188	182	370	—	60	155	150	5		41	48
„ 9th ..	10	368	99	467	—	75	199	185	8	Average cost of Eggs per doz.:	40	47
„ 14th ..	11	288	114	402	—	70	144	175	13	Bought .. 3s. 0½d.	44	53
„ 21st ..	12	387	120	507	—	124	200	183	—	Produced .. 1s. 7¾d.	36	48
„ 28th ..	13	370	—	370	—	95	160	112	3		30	41
Mar. 7th ..	14	460	—	460	—	95	188	180	6	Day-old chickens bought:—	38	48
„ 14th ..	15	474	—	474	—	83	186	195	10	£9 14 10	41	50
„ 21st ..	16	535	—	535	—	118	178	230	9		43	55
„ 28th ..	17	617	—	617	—	132	226	248	11	Average cost of Eggs per	40	51
Apl. 4th ..	18	460	—	460	—	92	120	236	12	chick hatched (excluding	51	64
„ 11th ..	19	462	—	462	—	108	178	162	14	cripples):—	35	46
„ 17th ..	20	470	—	470	—	122	151	189	8	4½d.	40	54
„ 24th ..	21	520	—	520	—	108	195	205	12		39	50
May 2nd ..	22	480	—	480	—	115	163	195	7		41	53
„ 9th ..	23	480	—	480	—	98	173	201	8		42	53
„ 16th ..	24	365	—	365	—	87	102	170	6		47	61
„ 23rd ..	25	495	—	495	—	103	204	183	5		37	47
„ 30th ..	26	480	—	480	—	98	168	205	9		43	54
	—	9,014	1,642	10,656	40	2,091	4,040	4,379	146	—	41	51

The fact that the same percentage of chickens was hatched each year from eggs obtained from various sources and from those produced on the holding is somewhat remarkable, and it should be remembered that, while the majority of the machines used were the same each season, some new incubators were introduced from time to time.

The profit and loss account* in connection with the "lean" demonstration in 1914–15 shows a loss of £35 4*s*. 1*d*. as compared with a net profit of £45 11*s*. 4*d*. in 1913–14, and on studying the figures it is not difficult to discover where the loss occurred. The rearing results for the three years are set out in the following table :—

Year.	No. of Eggs incubated.	Chickens hatched.	Chickens sold.	Percentage of losses in Chickens reared.
1912–13 ..	9,897	4,028	3,471	14 per cent.
1913–14 ..	10,431	4,285	3,549	17 ,, ,,
1914–15 ..	10,656	4,379	2,759	37 ,, ,,

From this table it is clear that the number of chickens which were lost in 1914–15 was very much higher than that in either of the former years. The percentage of losses in 1914–15 was more than double that of 1913–14. In 1915 Mr. Paynter marketed 1,581 birds in the usual way, and handed over 1,178 to the fatter. Thus out of 4,379 chickens hatched 2,759 only were reared to marketable size. Had the losses in 1914–15 not exceeded those of the previous season, some 870 additional birds would have been sold, and the financial result would have been very different.

For the birds which were sold Mr. Paynter obtained on an average 10½*d*. per lb. as compared with 9¼*d*. in 1913–14. The average cost of food per bird sold was 1*s*. 10½*d*.,† and the average price realised per bird was 3*s*. 3¾*d*. In 1913–14 the corresponding figures were 1*s*. 4¾*d*. and 2*s*. 10¾*d*.; thus in 1915 the actual return per bird over and above the cost of food was ¾*d*. less than 1914, but this was more than counterbalanced by the reduction in the cost of the eggs per chicken hatched.

The following table gives the cost of eggs in terms of chickens hatched, the cost of food per bird, the price realised per bird, and the profit per bird over and above the cost of eggs and of food consumed :—

* See Table III.

† The chickens sold are charged with the total cost of food, which includes, of course, the cost of that fed to the chickens which died.

Year.	Cost of Eggs per Chicken hatched.*	Cost of Food per Bird sold.	Total cost per Bird.	Price realised per Bird.	Profit per Bird over cost of Eggs and Food.
	d.	s. d.	s. d.	s. d.	s. d.
1912–13	4½	1 7	1 11½	2 10¼	10¾
1913–14	5¾	1 4¾	1 10½	2 10¾	1 0¼
1914–15	4½	1 10½	2 3	3 3¾	1 0¾

* The cost of the eggs here given is in terms of chickens hatched, not of chickens sold. The cost of food per bird sold includes the cost of the food of the birds which died or were lost.

The fluctuations in the costs shown in column 2 are partly due to the increased price of feeding-stuffs and partly due to the large percentage of chickens lost in 1915, but it is quite clear that Mr. Paynter succeeded in effecting a considerable reduction in the cost of feeding in 1913–14 as compared with 1912–13, although the average weight of the birds when sold in 1913 was slightly higher than in 1914.

TABLE II.—*Statement of Sales (Lean Chickens).*

Date.	No. of Birds.	Weight.	Value (less carriage and commission).
		lb.	£ s. d.
May 11th	33	115	6 7 6
„ 13th	30	118	5 14 6
„ 25th	29	105	5 7 3
„ 27th	15	55	3 0 3
June 1st	15	52	2 18 0
„ 1st	15	56	2 12 6
„ 4th	15	53	3 0 0
„ 4th	15	55	2 12 6
„ 11th	30	115	5 9 3
„ 11th	24	94	4 16 6
„ 18th	32	122	5 14 6
„ 19th	15	57	2 17 0
„ 25th	15	53	2 17 0
„ 25th	15	58	2 18 6
„ 28th	30	114	5 7 9
„ 30th	29	105	5 5 9
July 6th	15	58	2 17 6
„ 8th	15	56	2 6 3
„ 8th	27	101	5 0 6
„ 8th	15	53	2 17 0
„ 14th	30	111	5 6 3
„ 21st	30	116	5 5 9
„ 21st	1	3½	4 6
„ 28th	30	112	5 10 3
August 4th	8	30	1 16 0
„ 6th	15	59	2 14 0
„ 6th	7	26	1 4 6
„ 13th	48	190	7 7 0
„ 24th	30	118	4 17 3
„ 25th	18	71	2 16 6
„ 26th	35	146	5 13 3
Carried forward ..	681	2,577½	£122 15 3

TABLE II.—*continued.*

Date.	No. of Birds.	Weight.	Value (less carriage and commission).		
		lb.	£	*s.*	*d.*
Brought forward ..	681	2,577½	122	15	3
September 4th ..	50	198	8	7	0
„ 4th ..	69	273	10	17	9
„ 13th ..	20	81	3	9	3
„ 14th ..	39	158	6	13	0
„ 15th ..	50	206	8	8	9
„ 15th ..	6	23	1	4	0
„ 15th ..	15	57	3	0	0
„ 21st ..	25	97	4	1	0
„ 22nd ..	58	201	9	18	3
„ 23rd ..	22	101	3	2	6
„ 27th ..	16	63	2	14	9
„ 27th ..	1	4½		3	0
„ 28th ..	53	226	8	19	0
October 5th	32	123	5	11	6
„ 6th	59	241	8	11	3
„ 13th	45	183	7	10	9
„ 18th	40	167	6	2	0
„ 18th	28	105	4	12	9
„ 18th	16	62	2	14	0
„ 25th	48	201	7	9	6
„ 26th	32	132	5	7	0
„ 27th	28	115	4	8	3
November 1st-5th ..	30	117	4	4	6
„ 1st-5th ..	37	145	5	16	3
„ 1st-5th ..	15	58	1	15	9
„ 1st-5th ..	11	42	1	3	9
„ 1st-5th ..	27	106	3	2	0
„ 8th ..	4	17		7	6
„ 8th ..	5	18		10	0
„ ..	4	17		8	0
Taken by Mr. Paynter for own use at various times.	15	52¾	2	4	0
Total	1,581	6,167¾	£265	12	3

Average weight of chickens when sold, 3·90 lb.; average price received per pound, 10¼*d.*

In addition, 1,178 chickens were retained in connection with the Fatting Birds demonstration:—

Their estimated value being £190 14*s.* 6*d.*

Total value of chickens reared, £456 6*s.* 9*d.*

The loss of the 1,620 chickens is not easy to explain, and it placed a heavy handicap on the chances of profit-making. There was no serious outbreak of disease among the chickens, but the losses from vermin may have been higher than usual owing to the prevalence of rats in the moat surrounding the house. Mr. Paynter attributes the loss to the depredations of rats, stoats and hawks, and to the presence of visitors, which led to the neglect of the brooders and the chilling of the chickens, with the result that 5 broods perished.

Apart, however, from this unfortunate wastage and the failure to obtain a higher proportion of chickens from the eggs produced on the holding as compared with eggs bought from various sources and sent by rail, the 1914–15 results show considerable uniformity with those of 1912–14. The charges for labour were higher than in the previous season by £18 14*s.*, and the cost of repairs and renewals rose from £1 13*s.* in 1913–14 to £2 13*s.* 0*d.* in 1914–15. As against this additional expenditure there was a saving of £20 11*s.* 9*d.* in eggs for hatching and of £3 14*s.* 8*d.* in oil consumed.

In reviewing these demonstrations on chicken rearing as a whole it must be admitted that from a financial standpoint the results have not realised expectations, but they have been tested by a severe standard. For all intents and purposes the accounts presented are those of a poultry farm specialising in the production of table chickens, not those of poultry rearing for the table as a *branch* of the small holder's activity, which it was Mr. Paynter's intention to advocate. Nothing was produced on the holding for the poultry, and even the effect of the manure on the land is left out of account.

In so far as Mr. Paynter's chief purpose was concerned, viz., that of simplifying the production of table chickens on a fairly large scale, the three years' experience has indicated directions in which modifications might be introduced, but the system has, on the whole, proved distinctly practical. Each season 2,700 to 3,500 chickens were reared to marketable size on a limited area; the birds when sold were very uniform, and losses from disease were negligible.

The supply of eggs always proved a difficulty, partly because Mr. Paynter moved from place to place and could not establish a local connection; but it is clearly a great advantage for them to be produced on or near the holding. Where eggs are hatched on so large a scale a composite incubator with a single source of heat would probably prove more economical than separate machines. The use of a great number of small brooders is uneconomical in labour, and if large numbers of chickens are to be reared on the farm or small holding a form of brooder giving greater freedom for inspecting the chickens, and involving less constant attention in regulating temperature in response to changes in the condition of the weather, is essential. Several modern hovers appear likely to meet these requirements.

Mr. Paynter's system has the merit of reducing rearing as far as possible to a regular routine, but the results of 1915 clearly demonstrate that it does not eliminate the importance of the personal factor or remove the need for care and fore-

TABLE III.—*Mr. F. G. Paynter's Poultry Demonstrations at Morden Hall, Guilden Morden, Cambs.*

(1) LEAN BIRDS DEMONSTRATION. PROFIT AND LOSS ACCOUNT, 1914-15.

Dr.

Date	Particulars	£ s. d.	£ s. d.
1915. 31 Oct.	To Food consumed		257 7 8
	,, Oil used		11 10 0
	,, Eggs purchased		20 14 11
	,, Net cost of producing 8,974 eggs from home stock birds (including cost of food and labour, and making allowance for depreciation of plant and interest on capital)		61 6 3
	,, Chickens (day-old) purchased ...		9 14 10
	,, Repairs and renewals		2 13 0
	,, Railway carriage and cartage ...		31 6 3
	,, Labour (one assistant for whole year and one boy for part-time)	71 10 0	
	Less proportion not applicable to demonstration	19 10 0	
			52 0 0
	,, Salesmen's commission		13 9 9
	,, Rent rates and taxes (proportion applicable to Lean Birds Demonstration)		12 11 8
	,, Miscellaneous expenses		4 6 8
	,, Depreciation of plant at 10 per cent per annum:—		
	£236 15*s*. 11*d*. for whole year	23 13 7	
	£41 6*s*. 10*d*, (plant purchased during the year)	2 17 0	
			26 10 7
	,, Interest on capital (£360 at 5 per cent. per annum)		18 0 0
			£521 11 7

Cr.

Date	Particulars	£ s. d.
1915. 31 Oct.	By Chickens sold (1,581)	292 14 6
	,, Chickens (1,178) taken over by Fatting Birds Demonstration at agreed valuation	190 14 6
	,, Manure sold	2 18 6
		486 7 6
	Net loss	35 14 1
		£521 11 7

I have drawn up the above Account of the Lean Birds Demonstration at Morden Hall, Guilden Morden, for the year ended the 31st October, 1915, and have examined the same with the books and vouchers kept by Mr. Paynter.

thought. The importance of constant care is strikingly illustrated in the last season's work, where, owing to temporary neglect in the management of the brooders, a large number of chickens were lost. The introduction of improved appliances may tend to visit temporary negligence with less severe penalties, but no system of chicken rearing is ever likely to be automatic.

The work of Mr. Paynter was directed almost entirely to the production of table chickens, but on that account it should not be assumed that the production of table chickens is either more profitable or better suited to the small holder's conditions than egg production. A sound system of rearing is essential for success in either direction, and with certain modifications the methods advocated by Mr. Paynter could be used for rearing laying stock.

The Fattening Trials.

In 1914–15 the method adopted, as has already been stated, was to fatten a certain number of chickens according to Sussex practice.

For this purpose a consignment of birds when ready for marketing was divided: the birds in one lot were sent direct to London and sold as they came from the runs; the birds in the other lot were handed over to a trained fattener and were trough-fed and crammed. These birds were debited to the fattening account at the average price realised for the birds that were sent direct to London for sale.

In 1914–15 the system of feeding was modified; instead of allowing the birds to be trough-fed for the usual period they were trough-fed for as short a time as possible—which did not generally exceed 3 to 4 days—and then crammed. This modification was suggested by the fact that, as a general rule, the chickens reared by Mr. Paynter's methods came into the fattener's hands in exceptionally good condition, and by certain tests which were carried out at the end of the season of 1914, it was felt that it was worth while endeavouring to ascertain whether satisfactory results could be obtained in fattening the chickens on a modified system involving a less expenditure of food.

The following table give particulars of the birds fattened in each year:—

Year.	No. of Birds *handed to* Fatter.	Average weight.	No. *sold* Fat.	Average weight when sold.	Average increase in weight.	Average Price less carriage and commission.
		lb.		lb.	lb.	s. d.
1913–14	1,079	4·05	1,063	5·28	1·23	4 5½
1914–15	1,178	3·76	1,171	4·70	0·94	4 9

TABLE IV.—*Number, Weight and Value of Birds when put into Fattening Pens and when Sold.*

No. of Brood.	Number, Weight, and Value of Birds put into fattening pens.					Number and Weight of Birds sold and Prices realised.					Average increase in weight.
	Date when Birds were put up.	No. of Birds put up.	Average weight of Birds when put up. (Fasted.)	Value per head when put up.	Total value of Birds when put up.	Birds sold during week ending	No. of Birds sold.	Average weight of Birds when sold. (Fasted.)	Total sum realised from sales of Birds.*	Average net price obtained per Bird.*	
			lb.	*s. d.*	*£ s. d.*			*lb.*	*£ s. d.*	*s. d.*	*lb.*
1	April 21st ..	62	3·40	3 9	11 12 6	May 8th ..	61	4·30	14 3 0	4 7¾	·90
2	" 25th ..	72	3·37	3 9	13 10 0	" 15th ..	72	4·06	16 7 0	4 6½	·69
3	May 5th ..	72	3·57	3 6	12 12 0	" 22nd ..	72	4·31	16 10 9	4 7	·74
4	" 11th ..	72	3·68	3 6	12 12 0	" 29th ..	72	4·44	17 18 0	4 11¾	·76
5	" 19th ..	36	3·67	3 6	6 6 0	June 5th ..	36	4·33	8 5 0	4 7	·66
6	" 26th ..	72	3·82	3 6	12 12 0	" 12th ..	68	4·72	15 16 6	4 7¾	·90
7	June 2nd ..	72	3·78	3 3	11 14 0	" 19th ..	72	4·71	17 19 3	4 11¾	·93
8	" 9th ..	72	3·58	3 3	11 14 0	" 26th ..	72	4·57	18 8 0	5 1¼	·99
9	" 15th ..	72	3·68	3 3	11 14 0	July 3rd ..	72	4·62	17 11 6	4 10½	·94
10	" 22nd ..	72	3·64	3 3	11 14 0	" 10th ..	72	4·49	17 9 6	4 10¼	·85
11	" 29th ..	72	3·94	3 3	11 14 0	" 17th ..	72	5·07	17 13 6	4 11	1·13
12	July 6th ..	72	4·03	3 0	10 16 0	" 24th ..	72	4·94	17 10 0	4 10¼	·91
13	" 13th ..	72	4·01	3 0	10 16 0	" 31st ..	72	5·10	18 7 6	5 1¼	1·09
14	" 20th ..	72	4·03	3 0	10 16 0	August 7th ..	71	5·01	17 9 0	4 11	·98
15	" 27th ..	72	4·03	3 0	10 16 0	" 14th ..	72	4·76	16 7 3	4 6½	·73
16	August 3rd ..	72	3·82	2 9	9 18 0	" 21st ..	72	5·18	15 0 3	4 2	1·36
17	" 10th ..	72	3·76	2 9	9 18 0	" 28th ..	71	4·99	15 4 0	4 3¼	1·23
Total or Average	—	1,178	3·76	3 2¾	190 14 6	...	1,171	4·70	278 0 0	4 9	·94

* Less carriage and commission.

TABLE V.—*Quantity of Foods used in each week of the Fattening period.*

Week ending.	Ground Oats.	Sharps.	Fat.	Milk.	Grit.
	lb.	*lb.*	*lb.*	*Tins.*	*lb.*
April 24th..	57	55	3	9½	3½
May 1st..	153	154	11	12½	6
,, 8th..	139	140	7	14	3
,, 15th..	144	178	4	12	6
,, 22nd..	178	45	14	8	8
,, 29th..	198	46	11	23	2
June 5th..	228	70	14	18	6
,, 12th..	205	48	12	21	–
,, 19th..	236	58	13	22	6
,, 26th..	232	49	6	21	–
July 3rd..	241	49	21	25	–
,, 10th..	242	72	10	27	6
,, 17th..	256	51	10	26	–
,, 24th..	267	56	12	19	7
,, 31st..	222	43	13	26	–
Aug. 7th..	247	44	15	22	–
,, 14th..	245	43	14	22	11
,, 21st ,, 28th	91	28	7	5	–
Total ..	3,581	1,229	197	333	64½

TABLE VI.—*Summary of Results.*

Number of chickens put into fattening pens ..	1 178
Average weight	3·76 lb.
Value per head	3*s.* 2¾*d.*
Number sold fat	1,171
Average weight when sold	4·70 lb.
Average price obtained after deducting carriage and commission	4*s.* 9*d.*
Average increase in weight	0·94 lb.
Weight of food used :—	
Ground Oats	31 cwt. 109 lb.
Sharps	10 ,, 109 ,,
Fat	1 ,, 85 ,,
Grit	64½ ,,
Milk	333 tins

The following table gives particulars of the weight of food used in each year :—

Year.	Ground Oats.	Sharps.	Fat.	Grit.	Condensed Milk.	No. of Birds fattened.
	cwt. lb.	*cwt. lb.*	*cwt. lb.*	*cwt. lb.*	*Tins.*	
1913–14	41 37	25 64	2 25	1 0½	489½	1,063
1914–15	31 109	10 109	1 85	64½	333	1,171

The average increase in weight in 1914 was 1·23 lb. and in 1915 ·94 lb., but owing to the increase in the price of feeding-stuffs the ·94 lb. increase cost as much to produce in 1915 as the increase of 1·23 lb. in 1914.

TABLE VII.—*Mr. F. G. Paynter's Poultry Demonstrations at Morden Hall, Guilden Morden, Cambs.*

(2) FATTING BIRDS DEMONSTRATION: PROFIT AND LOSS ACCOUNT, 1915.

Dr.

Date		£ s. d.	£ s. d.
1915. 31 Oct.	To Chickens (1178)* taken over from Lean Birds Demonstration at agreed valuation...		190 14 6
	,, Food consumed		35 15 0
	,, Railway carriage and cartage ...		13 11 4
	,, Labour (one fatter and one stubber for 19 weeks)	43 16 3	
	,, Less proportion not applicable to Demonstration	10 0 8	33 15 7
	,, Salesmen's commission		14 12 3
	,, Rent, rates, and taxes (proportion applicable to Fatting Birds Demonstration)		2 0 0
	,, Miscellaneous expenses		1 6 8
	,, Depreciation of Plant at 10 per cent. per annum		1 7 3
	,, Interest on Capital, £85, for part year at 5 per cent. per annum ...		2 5 0
			295 7 7
		Net profit ...	8 13 0
			£304 0 7

Cr.

Date		£ s. d.
1915. 31 Oct.	By Fat chickens sold (1,171)*	300 15 9
	,, Manure sold	1 13 0
	,, Feathers sold	1 11 10
		£304 0 7

* Seven chickens were lost by death, thefts, &c.

I have drawn up the above Account of the Fatting Birds Demonstration at Morden Hall, Guilden Morden, for the year 1915, and have examined the same with the books and vouchers kept by Mr. Paynter.

P. J. LANGLEY,
Assistant Accountant,
Board of Agriculture and Fisheries.

6th March, 1916.

An examination of the results in 1913–14 and 1914–15, based on the total energy value of the food supplied, shows that in 1913–14 the energy value of the food amounted to 8,650 calories per lb. increase in weight, whereas in 1914–15, dealing with approximately the same number of birds, 1 lb. increase in weight was obtained from an expenditure of 6,750 calories, or 78 per cent. of the energy value supplied in the previous year.

The figures are set out in the following table :—

Year.	No. of Birds fattened.	Energy Value per Bird.	Energy Value supplied per pound increase.
1913–14	1,063	10,640	8,650
1914–15	1,171	6,350	6,750

The net profit on the fattening of 1,171 birds in 1915 was £8 13*s.* and £33 15*s.* 7*d.* was paid in wages; therefore a skilled fattener would have obtained a very reasonable return for his labour.

Although the fattening of the chickens proved profitable in both seasons, there is reason to call attention again to the comments made in connection with the report on the previous season's results. Fattening involves skill, and it entails an additional risk, and, unless a small holder has experience and is prepared to devote special care and attention to it, he would probably find it much better to sell the chickens straight off the runs.

If the whole method were conducted on co-operative lines so that one man specialised in producing the eggs, another in hatching and rearing the chickens, and a third in fattening them, it is quite possible that *under normal conditions* such a combination might prove advantageous, but the fattening of the chickens is in no sense an integral part of Mr. Paynter's system.

THE USE OF SULPHATE OF AMMONIA FOR WHEAT.*

ON many poor clay soils wheat is greatly benefited by phosphatic manures, such as basic slag or superphosphate, which encourage early root development, but it may be stated that as a general rule the most marked improvement in the wheat crop

* Reprint of Special Leaflet No. 46 (*Top Dressing Wheat in Autumn*) revised in August, 1916.

follows the skilful use of nitrogenous manure. Apart from farmyard manure the best source of nitrogen for wheat available for use in the season 1916-17 is sulphate of ammonia; occasionally, where fish guano can be purchased to advantage, it will prove as useful as sulphate of ammonia, and it should be preferred on soils very poor in lime. In this article the use only of sulphate of ammonia is discussed, since it is assumed that most farmers will purchase the nitrogen required by the wheat crop in this form.

In the article in this *Journal* for November, 1915, p. 777, reference was made to the old practice of top-dressing wheat in the autumn, and it was recommended that in certain cases a part of the nitrogenous dressing should be used in the late autumn. It was pointed out that if the winter was moderately dry and the spring dry and cold, autumn manuring would be likely to give the best results on poor land. The season 1915-16 was unsuited for autumn dressing. The heavy spring rainfall and the fine "growing" weather in May favoured spring manuring, but reports from various parts of the country indicate that those who did manure their land late in the autumn were well satisfied with the result.

Reasons for recommending Autumn Dressings.—Much surprise was expressed by farmers last year that the Board should have advocated autumn dressing with sulphate of ammonia, and the comments made indicated that the principles on which the advice was based were not fully understood; it will therefore be desirable to explain the position more fully in this article.

With regard to the use of sulphate of ammonia the experimental evidence available shows that when winters are normal and the late spring months are dry, autumn dressing gives a better result than spring dressing; when the winters are wet and the late spring is favourable for growth, spring dressing is better. On the average of years, if a dressing not exceeding say ¾ cwt. sulphate of ammonia is to be used, spring dressing may be expected to pay better.

When wheat is high in price, it certainly pays to use more than ¾ cwt. sulphate of ammonia on all clay soils or strong loams which in ordinary circumstances may be expected to give not more than 36 bush. per acre if unmanured. It is undesirable to give more than 1 cwt. in a single dressing, and the best result may be expected from a total dressing of 1¼ to 1¾ cwt. if from ½ to ¾ cwt. is applied in the autumn and the balance in the spring.

Comparatively little sulphate of ammonia has been used by the present generation of farmers for autumn dressing, partly

because of the low price of wheat, and there is, therefore, very little direct information on the subject; but in many districts farmyard manure is regularly applied to wheat in autumn, and the beneficial effect of this manure is mainly due to the nitrogen which it provides. Further, though sulphate of ammonia has been rarely used in the autumn, compound wheat manures are frequently applied, and many of such compound manures contain sulphate of ammonia.

In mild districts early sown wheat is apt to become too strong in the leaf in autumn or early spring, and where this "winter-proud" condition is anticipated there is no need for autumn manuring. But, unfortunately, winter-starved wheat is a much more common sight than winter-proud wheat in this country, and while the winter-proud condition can be corrected by grazing, nothing can be done for a winter-starved crop if the spring months are dry and cold.

It is often supposed that since sulphate of ammonia melts readily in water it is washed out of the soil in the way that nitrate of soda is washed out, and it is argued that autumn dressing necessarily involves a heavy loss. In one sense there is always a heavy loss when quick-acting nitrogenous manures are used. It is, indeed, in the process of being "lost" (that is, washed down through the soil) that nitrogenous manures do their best work. Under ordinary circumstances from one-half to three-fourths of the manure applied never enters the crop; but the balance may yield an ample profit. If 1 cwt. of sulphate of ammonia produces an extra sack of wheat, it means that one-third of the nitrogen is actually recovered in the crop. The *rest is usually lost, but is "profitably lost," at present prices.* In fact, however, the soil has a remarkable power of retaining sulphate of ammonia, and so long as this substance retains its original character very little is lost. What happens is that if the soil is moist and the temperature well above the freezing point the sulphate of ammonia becomes changed into a nitrate, and this nitrate is then either taken up by the crop or washed down into the drains or the subsoil.

The change from ammonia is very slow in cold soil and until the temperature reaches about 40° F. no considerable change begins; in a warm soil the change is rapid, so that in moist warm weather in May the effect of the nitrate which is formed from ammonia may be seen on crops like rye-grass three or four days after a dressing of sulphate of ammonia has been applied.

Treatment of Wheat Crop.—To use manure successfully a farmer must not only know his soil and understand the way

in which the manure acts, but he must study the needs of the crop. In a general way it may be said that the best results with wheat are got when the plant is kept growing steadily. An occasional sharp check does no harm on good well-manured land, in fact it is useful in making the plant stool well, but the kind of check that wheat gets on poor land between December and March when the weather is either very cold or very wet is most harmful, and the farmer should aim at preventing it by getting the plant well rooted before January.

These being the conditions, how ought the crop to be treated? On good land early sowing will go far to secure sufficient root development; on land in moderate or poor condition suitable manuring will be required as well, all the more so if the seed is not sown in good time. If autumn sowing or manuring is too long delayed the plant will be badly developed in the early spring, it will start the new season's growth in a weak condition, and, unless the late spring is very favourable, it cannot grow into a good crop. On the other hand, if sulphate of ammonia were used in the early autumn, and warm wet weather followed, there might be considerable waste. The only general statement that can be made is that while the country is at war it is much better for all concerned to risk losing some manure in autumn than to risk growing a poor crop.

Gain obtained by Use of Sulphate of Ammonia.—The skilful use of 1 cwt. of sulphate of ammonia should, with ordinary luck in the way of weather, result in an extra sack of wheat at harvest. Sulphate of ammonia can be purchased at 15*s.* per cwt. during August and September and at 15*s.* 6*d.* thereafter, and the sack of wheat may be worth twice as much; there is, therefore, a wide margin on which to estimate a profit. By this time, too, most farmers no doubt realise that every extra sack of wheat which they grow is a definite contribution to the country's war chest.

The country is importing over 50 per cent. of its food, and for every sack of wheat which farmers fail to grow we must either allow 100 of our people to go short of food for a day or send money out of the country which, if retained at home, would provide 240 cartridges.

Recommendations.—A certain amount of risk is unavoidable in using manures. If however, the following recommendations are followed, it is improbable that wheat growers will have any reason to regret their action when the harvest of 1917 is gathered.

1. All wheat soils in moderate or poor condition, and especially clay soils or those growing a second white crop,

should have some phosphatic manure in autumn; as a rule 2–3 cwt. basic slag per acre should be given at sowing time. Where basic slag is known not to suit the soil, a small dressing of superphosphate, say 1 cwt. per acre, may be applied. (As superphosphate will be scarce in 1917 farmers should reserve their supplies for roots, barley, and other crops more dependent than wheat on a quick-acting manure. Finely ground mineral phosphates may be employed in place of superphosphate for wheat on loamy soils.)

2. Arrangements should be made for top-dressing all autumn-sown wheat crops, except those growing on the richest class of soil, with from $\frac{3}{4}$ to 1 cwt. sulphate of ammonia between the middle of February and the end of March.

3. Sulphate of ammonia should not be applied in autumn to rich soils or to land dunged before sowing wheat; in all other cases a dressing of sulphate of ammonia should be given before 1st January to autumn-sown wheat.

4. From $\frac{3}{4}$ to 1 cwt. sulphate of ammonia should be applied to soils of medium quality about the middle of December; if the weather is then wet the application should be deferred until the first dry period thereafter.

5. On poor land, or after a white straw crop, $\frac{1}{2}$ cwt. per acre of sulphate of ammonia should be applied when sowing or at any time before the middle of November; and a further $\frac{1}{2}$ to $\frac{3}{4}$ cwt. at the end of the year.

The Board are informed by the Sulphate of Ammonia Association that sulphate of ammonia (24½ per cent. ammonia) will be offered for sale till the end of September at 15*s. per cwt. net cash, on condition that the quantities purchased at this reduced rate are removed from the sellers' works by the* 30*th September,* 1916.

After that date, the price will be raised to 15*s.* 6*d. per cwt. net cash, f.o.r., at makers' works in bags.*

Farmers are strongly recommended to take advantage of the reduced terms offered by the Association, as they will thereby facilitate delivery and also secure supplies which, owing to the increased requirements of the Ministry of Munitions, may not be so easily obtainable next year.

The President of the Board has appointed a Committee to make arrangements for the supply of fertilisers. Farmers who have any difficulty in securing supplies of sulphate of ammonia at the prices stated should communicate at once with—*The Secretary, Board of Agriculture and Fisheries (Fertilisers Committee),* 3, *St. James's Square, London, S.W.*

SWEET STACK SILAGE.

T. WIBBERLEY, N.D.A., N.D.D.

IN connection with the continuous cropping system of tillage, the writer has adopted a special system of making sweet stack silage for use when weather conditions are unsuitable for the making of hay. To make sweet stack silage on this plan the forage crop is cut by the ordinary mowing machine. If the crop is lodged, the work of cutting is facilitated by fitting the machine with a pea harvester. It may be pointed out, however, that in the case of a crop like tares lodging is easily avoided by sowing a larger proportion of cereals or beans than of vetches. To facilitate drying and the use of the horse sweep and swathe turner the crop is cut so as to leave a high stubble. When the swathes have become dry on the upper surface they are turned completely over with a swathe turner. Immediately the swathes are turned, they are hauled direct to the stack by means of a small horse sweep, or, if stacking in the field is not possible, by means of a hay bogie or rick shifter. Much less labour is involved in loading the crop on such a low built conveyance as this, than on to the ordinary farm cart or wagon.

Stacking.—The stack is usually built in circular form with a base diameter of from 18 to 24 ft. A layer of waste material is laid on the ground to form the base of the stack; a few sweep rake loads are then tipped direct on to the base, trimmed up and shaken into position with a hand fork. After the stack is 3 or 4 ft. high all further lifting is done with the horse fork. In building, the outer edge of the stack is made to slope slightly inwards from the base, and when a height of about 15 ft. has been reached, and the stack settled, the outer edge is trimmed off with a sharp hay-knife—starting at a height of about 12 ft. from the ground—the portion trimmed off being placed on top of the stack. This trimming off is done to minimise the waste at the outside.

The stack should be built as high as possible, and generally speaking, with an ordinary horse fork, this will mean about 15 ft. high when the stack has settled down. In order to allow time for the stack to settle, and with a view to controlling the temperature, it will be found, in practice, a great convenience to build two stacks at the same time. Where there is only sufficient material for one stack of the above dimensions, two smaller stacks should be made, or the operations may be proceeded with at intervals of several days.

Weighting of the Stack.—The silage stack may be weighted by building on top of it, when settled, a small stack of hay, a layer of waste material being placed between the silage and the hay. When this is not convenient, the silage stack should be finished off about 4 ft. higher in the centre than on the outside. In a few days, the centre will have sunk nearly level. The stack may then be finally topped off as before described. On top of the waste layer, soil to the depth of 9 in. or 12 in. is placed. If the stack is built on a piece of grass land, the turves may be cut all around the stack and placed grass side down on the outer edge of the stack to act as a coping.

There is a considerable amount of labour expended in covering the stack with soil, but saving may be effected in various ways. In the first place, hand digging of the soil may be avoided by drawing a cultivator or disc harrow round and round the stack, until sufficient material has been obtained, whilst the soil may be raised to the top of the stack by fitting a box on to the haulage rope of the horse fork.

As the stack settles down, cracks will appear in the layer of soil. These should be closed with a hand rake, using the back of a spade to smooth off.

The Temperature of the Stack.—Apart from the greater labour required when silage is made on the ordinary plan there is far less waste in the method here recommended. The silage is sweet, free from mould, very palatable, and when a little experience has been obtained, it may be made, so that when the stack is cut into, the silage is almost as green as on the day it was carted.

Success depends upon controlling the temperature properly in the making. This can be done by regulating the rate of building and by using salt. The condition of the forage has also an important bearing on the temperature. If it is green and wet and is stacked very rapidly without stopping, the temperature will not generally rise beyond 120° F., and the resulting silage will be very wet, sour, and have a most disagreeable smell. If the crop is insufficiently dried the base of the stack will probably be sour, the middle sweet, and the top may become "browned." As regards the possibility of spontaneous combustion, there seems to be far less danger than is generally imagined. In order to attain the best results, it is advisable to spread over the stack from 7 to 14 lb. of agricultural salt after the addition of every ton of silage material. When the stack contains about 30 tons it is left alone, until the temperature rises to from 130° F. to 140° F.

Immediately this temperature is reached another 30 tons or so is added to the stack, which is once more left until the temperature reaches the same level and so on, until the stack is completed. If this is done, and the recommendations as to the use of salt and weighting of the stack are followed, the maximum temperature attained will seldom exceed 160° F. If there is any danger of the temperature exceeding this figure when the stack is finished, the best course is to strip off part of the soil and pour on the stack from 40 to 80 gal. of strong brine. This is, of course, not possible where a stack of hay is built on top of the silage, but if the hay-stack is added, before a temperature of 140° F. has been attained, no danger of the temperature passing 160° need be anticipated.

The effect of the salt in controlling the temperature is probably due to its antiseptic nature, but on this, and many other points in connection with silage making and the chemical changes connected with same, there is great need for further research.

In continuous wet weather, it is sometimes difficult to dry silage material sufficiently to make silage on the above plan. Where this is the case, the best course is to mix with the green material straw or hay left over from the previous year, at the rate of one ton of dry material for every 10 to 15 tons of the wet forage. In this way the excessive moisture is absorbed.

Very useful silage may be made on the plan outlined, and even hay which has become mouldy in the swathe may be turned to advantage with freshly cut forage. About one part of hay should be used with two parts of the forage.

The simplest means of ascertaining the temperature is to place in the centre of the stack an iron pipe of about 2 in. diameter and lower the thermometer down the pipe with a piece of twine, closing the top of the pipe to exclude cold air whilst the temperature is being taken.

FEEDING EXPERIMENTS WITH RABBITS.

C. J. DAVIES.

IN order to obtain precise details of the relative merits of various concentrated foods, the total amount of food consumed, and the cost of rearing, eight rabbits of similar breed and about the same age, belonging to two litters, were experimentally fed for six weeks in the summer of 1916.

When bought, the rabbits were, with one exception, small for their age and in poor condition. They quickly improved

however, maintained perfect health throughout, and at the close of the experiments were all sleek and in excellent form.

The rabbits were put together in braces of as nearly the same weight as possible, seven of them averaging just over 1 lb. in weight at six weeks old. One very large and one rather small one were put together and fed on oats as representing the commonest class of concentrated food used by fanciers for all sorts and conditions of rabbits.

The animals were housed in a four-compartment stack of hutches standing in an outhouse, each pen being 2 ft. 9 in. long and 2 ft. wide. They received water to drink and a lump of rock salt to lick, and the hutches were littered with peat-moss dust.

The following table shows the class of concentrated food given, its analysis and approximate cost, and the average increase in live-weight of each rabbit. The prices are maximum ones for food bought locally in small quantities :—

Concentrated food.	Cost per lb.	Cost of Amount consumed per head in 6 weeks.	Average increase in live weight in 6 weeks.
Lot 1.—Bran only, Alb. 14, Oil 4.	1*d.*	2*d.*	1 lb. 9½ oz.
„ 2.—Oats only, Alb. 12, Oil 6.	2*d.*	4*d.*	1 „ 10½ „
„ 3.—Bran 2 parts, oatmeal 1 part, dairy cake 1 part, Alb. 18, Oil 6.	1½*d.*	3*d.*	1 „ 10¼ „
„ 4.—Dairy cake only, Alb. 24, Oil 6.	1½*d.*	3*d.*	1 „ 2¾ „

The rabbits received, in addition, a small daily allowance of second-cut clover hay and green stuff in the form of freshly cut meadow grass and chicory.

The following table shows the approximate amount of food of all kinds given daily to each pair of rabbits :—

Daily ration of each brace.	Age of Rabbits.					
	6 weeks.	7 weeks.	8 weeks.	9 weeks.	10 weeks.	11 weeks.
Concentrated food ..	1 oz.	1 oz.	1 oz.	1½ oz.	2 oz.	2 oz.
Clover hay	1 „	1 „	1 „	1 „	1 „	1 „
Green stuff	10 „	14 „	1 lb.	1 lb.	1 lb.	1 lb.

It should be remarked that the hay and green food were almost invariably eaten up cleanly and that the remains of food scraped out at the end of 24 hours never exceeded an ounce of inferior stalk or withered stuff.

At the end of six weeks Lot 3 carried the most flesh, but no exception could be taken to the condition of any of the rabbits. The brace fed on bran were very lean during the first three weeks but improved rapidly when the ration was increased. The poor result obtained from the pair fed on dairy cake only was partly due to the fact that one rabbit disliked it and seldom ate her share. At the same time this food was undesirably high in albuminoids for young rabbits and the particular make used was also thought to have an unduly large percentage of fibre.

The mixture given to Lot 3, which had been given successfully throughout the year to a number of other animals, was on analysis the most suitable, and the results seem to support the view gained from experiments with farm animals that a mixture of foods gives relatively better results than single foods.

The experiments seem to prove conclusively that the use of oats is both extravagant and unnecessary, as similar results are obtainable with other foods at far less cost. It appears that rabbits of a medium-sized breed can be reared for the six weeks of their greatest growth in summer at a cost for concentrated food of one-halfpenny per week each. If bran only is used, the cost will be still further reduced, but it is questionable whether it does not pay best to use a rather more expensive mixture which ensures an uninterrupted growing period.

Roughly speaking, it was found that it took some 15 lb. of food to obtain an increase of 1 lb. in the weight of a rabbit. This approximates very fairly with observations made by the writer many years ago in the case of a smaller variety, when it was estimated that each rabbit increased 1 lb. for every 12 lb. of food consumed.

An attempt was made to ascertain the amount of manure produced and, although the methods adopted were crude, the results were so consistent that they are probably fairly accurate. It was estimated that during six weeks each young rabbit produced on an average 9 lb. to 10 lb. of dry and liquid manure.

Prices.—The usual tables of prices per ton and per unit are given below. Comparison with last month shows a general rise. Cakes are dearer by about a 1*d.* per unit, and this is about the amount of the rise in price of most feeding stuffs. Wheat offals are exceptional, having risen in price by from 1¾*d.* to 4¼*d.* per unit. Almost the only case of a fall in

Notes on Feeding Stuffs in September: *From the Animal Nutrition Institute, Cambridge University.*

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of August. London.	Liverpool.	Hull.	Bristol.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soya Bean Cake	122·3	13 0 0	—	12 15 0	—
Decorticated Cotton Cake	126·3	13 0 0	12 10 0	—	—
Indian Linseed Cake ..	123·1	*13 10 0	12 15 0	—	—
English Linseed Cake ..	120·1	*13 11 3	14 0 0	13 5 0	14 5 0
Bombay Cotton Cake ..	65·3	9 15 0	10 0 0	9 15 0	9 5 0
Egyptian Cotton Cake ..	71·9	9 13 9	10 15 0	10 5 0	10 5 0
Coconut Cake	102·6	10 11 3	10 15 0	—	11 2 6
Palm-nut kernel Cake ..	96·1	8 12 6	8 17 6	8 15 0	9 15 0
Ground-nut Cake ..	145·2	†12 10 0	—	12 15 0	12 5 0
English Beans	99·5	‡12 12 8	13 10 8	12 12 8	—
Chinese Beans	101·2	‡12 5 0	12 16 8	—	—
English Maple Peas ..	97·2	‡13 6 8	—	13 15 7	—
English Dun Peas ..	97·2	‡12 8 11	—	11 13 4	—
Calcutta White Peas ..	97·5	§16 4 5	—	—	—
American Maize	93·8	11 13 4	11 18 11	11 15 8	—
Argentine Maize	94·2	§12 12 0 ‡12 2 8	13 1 4	12 19 0	12 19 0
Maize Meal	86·5	11 0 0	12 12 6	—	13 10 0
Maize Gluten Feed ..	121·6	10 10 0	—	—	11 5 0
Maize Germ Meal ..	99·2	10 15 0	12 0 0	12 0 0	12 10 0
English Feeding Barley ..	83·0	‡14 0 0	—	14 0 0	—
English Oats	75·4	§11 0 0 ‡12 0 0	‡12 0 7	11 16 8	11 10 0
Argentine Oats	75·4	§11 19 6	—	—	—
Malt Culms	69·9	7 0 0	8 10 0	7 0 0	8 0 0
Brewers' Grains (dried) ..	84·5	8 17 6	—	8 5 0	9 0 0
Brewers' Grains (wet) ..	21·1	1 1 6	—	1 10 0	—
Distillers' Grains (English)	101·2	9 0 0	9 0 0	—	10 5 0
Distillers' Grains (French)	101·2	9 0 0	—	—	—
Egyptian Rice Meal ..	78·7	11 0 0	—	—	—
Burmese Rice Meal ..	78·7	10 0 0	10 10 0	—	10 15 0
Wheat Middlings (coarse)	94·8	10 5 0	—	—	12 0 0
Wheat Sharps	90·5	10 10 0	10 15 0	11 0 0	11 0 0
Wheat Pollards	96·7	—	8 15 0	—	—
Wheat Bran	77·5	7 0 0	7 15 0	7 0 0	7 0 0
Wheat Bran (broad) ..	79·9	8 0 0	8 2 6	8 0 0	8 0 0
Feeding Treacle	60·0	10 5 0	12 5 0	11 5 0	—
Linseed	153·5	20 0 0	‖22 0 0	19 10 5	20 15 0
Linseed Oil	250·0	37 0 0	¶40 0 0	34 0 0	38 10 0
Egyptian Cotton Seed ..	108·6	12 15 0	—	12 0 0	—
Bombay Cotton Seed ..	99·6	—	—	—	—
Cotton Seed Oil { Refined	—	43 0 0	—	—	—
Cotton Seed Oil { Crude ..	250·0	38 15 0	¶48 0 0	—	43 10 0

* These are spot cash sales to clear. The price for September delivery is £14.
† 2nd grade (London) ...

price for a commonly used feeding stuff is English oats, which are cheaper than a month ago by ½*d*. per unit. Their present price of 3*s*. 1¾*d*. per unit is, however, still prohibitive.

Rations.—*Horses.*—The changes in prices do not call for any alteration in the mixtures suggested last month.

Cows.—Steps should be taken to counteract the scouring properties of the lush autumn grass, which should be abundant after the recent spell of warm showery weather. In the present state of knowledge it is not possible to suggest better practice for this purpose than the use of undecorticated cotton cake at the rate of 2 lb. per head, with an extra pound for each gal. of milk yielded above 2 gal., so long as the cows are on grass, cabbage, green maize or similar lush fodder. Cotton cake is still very dear, nearly 3*s*. per unit, but nothing else so efficiently prevents scouring with the attendant drop in yield and quality of milk; and at present milk prices, yield and quality must be maintained at all costs.

Where the amount of grass is short because of the purchase of extra cows to keep up the winter milk supply, it is advisable to get the cows on to their winter allowance of concentrated foods as soon as possible.

For cows yielding under 2 gal. of milk, a mixture of 2 parts of cotton cake and 1 part of bran may be used at the rate of 4 or 5 lb. per head per day, with an additional 4 or 5 lb. for each extra gal. of milk yielded. As long as the cows are on lush grass, or other lush fodder, this or some similar ration containing a large proportion of cotton cake is advisable.

As soon as they come on to winter foods, the following feeding stuffs may be included in the ration: Ground nut cake, linseed cake, decorticated cotton cake (in moderate quantity), coconut cake (in small quantities), palm nut kernel cake, maize gluten feed, and malt culms. All are useful foods for milk production at present prices, but ground nut cake, maize gluten feed and palm nut kernel cake are the cheapest amongst them.

For use with an ordinary ration of roots and hay or straw the following rations of concentrated foods may be suggested:—

	For Cow yielding 2 gal.	*For each extra gal over 2 gal.*
I.—	3 lb. bran. 2 lb. linseed cake. 1 lb. cotton cake.	4 lb. of same mixture.
II.—	2 lb. bran. 1 lb. palm-nut kernel cake. 1 lb. ground nut cake.	2½ lb. of same mixture.
III.—	2 lb. maize gluten feed. 2 lb. palm-nut kernel cake. 2 lb. bran or dried grains.	4 lb. of same mixture.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	0¼	American maize.. ..	2	5¾
Ground nut cake ..	1	8¾	English beans	2	6½
Maize gluten feed ..	1	8¾	Maize meal	2	6½
Palm-nut cake	1	9¼	Burmese rice meal ..	2	6½
Distillers' grains (English)	1	9¼	English dun peas ..	2	6¾
Distillers' grains (French)	1	9¼	Linseed	2	7¼
Wheat bran	1	9½	Argentine maize ..	2	8
Wheat bran (broad) ..	2	0	Egyptian cotton cake ..	2	8¼
Malt culms	2	0	English maple peas ..	2	9
Decorticated cotton cake	2	0¾	Egyptian rice meal ..	2	9½
Coconut cake	2	0¾	Linseed oil	2	11½
Brewers' grains (dried) ..	2	1¼	Bombay cotton cake ..	2	11¾
Soya bean cake	2	1½	Cotton seed oil (crude)..	3	1¼
Maize germ meal ..	2	2	Argentine oats	3	2¼
Wheat middlings (coarse)	2	2	English oats	3	2¼
Indian linseed cake ..	2	2¼	Calcutta white peas ..	3	4
English linseed cake ..	2	3	English feeding barley..	3	4½
Wheat sharps	2	3¾	Feeding treacle	3	5
Cotton seed	2	4¼	Cotton seed oil (refined)	3	5¼
Chinese beans	2	5			

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Distillers' grains (English)	1	9¼	Chinese beans	2	6½
Wheat pollards	1	9¾	Burmese rice meal ..	2	8
Palm-nut cake	1	10¼	English beans	2	8¾
Decorticated cotton cake	1	11¾	Argentine maize ..	2	9¼
Wheat bran	2	0	Linseed	2	10½
Wheat bran (broad) ..	2	0¼	Maize meal	2	11
Indian linseed cake ..	2	0¾	Egyptian cotton cake ..	3	0
Coconut cake	2	1¼	Bombay cotton cake ..	3	0¾
English linseed cake ..	2	4	English oats	3	2¼
Wheat sharps	2	4¾	Linseed oil	3	2½
Maize germ meal ..	2	5	Cotton seed oil	3	10
Malt culms	2	5	Feeding treacle	4	1
American maize	2	6½			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	Wheat sharps	2	5
Ground nut cake ..	1	9	American maize.. ..	2	6¼
Wheat bran	1	9½	English beans	2	6½
Palm kernel cake ..	1	9¾	Linseed	2	6½
Brewers' grains (dried) ..	1	11½	Linseed oil	2	8¾
Wheat bran (broad) ..	2	0	Argentine maize ..	2	9
Malt culms	2	0	English maple peas ..	2	10
Soya bean cake	2	1	Egyptian cotton cake ..	2	10¼
English linseed cake ..	2	2½	Bombay cotton cake ..	2	11¾
Egyptian cotton seed ..	2	2½	English oats	3	1¾
English dun peas ..	2	4¾	English feeding barley ..	3	4½
Maize germ meal.. ..	2	5	Feeding treacle	3	9

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	8¼	Maize germ meal ..	2	6¼
Wheat bran	1	9½	Wheat middlings ..	2	6¼
Maize gluten feed ..	1	10¼	Linseed	2	8½
Wheat bran (broad) ..	2	0	Burmese rice meal ..	2	8¾
Palm-nut cake	2	0¼	Argentine maize ..	2	9
Distillers' grains (English)	2	0¼	Bombay cotton cake ..	2	10
Brewers' grains (dried) ..	2	1½	Egyptian cotton cake ..	2	10¼
Coconut cake	2	2	English oats	3	0¼
Malt culms	2	3½	Linseed oil	3	1
English linseed cake ..	2	4¾	Maize meal	3	1½
Wheat sharps	2	5	Cotton seed oil	3	5¾

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	2¾	Chinese beans	2	5¾
Ground nut cake ..	1	8¾	English dun peas ..	2	5¾
Distillers' grains (French)	1	9¼	American maize.. ..	2	6¼
Maize gluten feed ..	1	9½	English beans	2	7¼
Wheat pollards	1	9¾	Burmese rice meal ..	2	7¾
Palm kernel cake ..	1	10¼	Linseed	2	8¼
Wheat bran	1	10¼	Argentine maize ..	2	8¾
Distillers' grains (English)	1	10¼	English maple peas ..	2	9½
Wheat bran (broad) ..	2	0	Egyptian rice meal ..	2	9½
Decorticated cotton cake	2	0¼	Egyptian cotton cake ..	2	10¼
Brewers' grains (dried) ..	2	0¾	Maize meal	2	10¼
Coconut cake	2	1¼	Bombay cotton cake ..	2	11½
Soya bean cake	2	1¼	Linseed oil	3	0
Indian linseed cake ..	2	1½	Cotton seed oil (crude) ..	3	1¼
Malt culms	2	2	English oats	3	1¾
Cotton seed	2	3¼	Argentine oats	3	2¼
English linseed cake ..	2	3½	Calcutta white peas ..	3	4
Wheat middlings ..	2	4	English feeding barley ..	3	4½
Maize germ meal ..	2	4½	Cotton seed oil (refined)	3	7
Wheat sharps	2	4½	Feeding treacle	3	9

These quantities are suitable for cows weighing about 9 cwt. They must be increased for heavier cows, or decreased for lighter cows at the rate of about one-ninth of the ration for each cwt. live weight above or below 9 cwt.

Cattle fattening on pasture.—As is the case with cows, cattle fattening on pasture at this time of year want something to correct the scouring properties of the lush grass, especially this showery season.

In spite of its high price, nothing can quite take the place of cotton cake. The following rations may be suggested:—

I.—2 lb. cotton cake.	II.—2 lb. cotton cake.
1 lb. coconut cake.	2 lb. ground nut cake.
2 lb. linseed cake.	2 lb. bran.

The rations are suitable for cattle weighing about 8 cwt.

live weight. They may be decreased by about one-eighth if the live weight is only 7 cwt., or increased by the same amount if the live weight is 9 cwt.

In the case of young stock, beans may be used in place of cotton cake, 2 lb. of beans being roughly equivalent in feeding value to 3 lb. of cotton cake.

Sheep for fattening will now be going on to white turnips, and may be given a very small allowance of cotton cake to prevent scouring. The bulk of their cake, however, should be ground nut cake, which last year proved to be a most successful and economical concentrated food for all kinds of stock fattening on roots, provided, of course, that it is used with discretion.

It contains nearly twice as much digestible protein as linseed

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English. " " French	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake	1 : 4·5	14·1	6·1	48·9	76·7	101
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple	1 3·1	17·0	1·0	50·0	70·0	92
Brewers' grains, wet	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·5	73·1	96
Wheat sharps	1 : 5·1	11·6	3·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad	1 : 4·7	11·3	3·0	45·4	48·1	63

cake and must be used along with some food or foods rich in starch or sugar. If used alone in large quantities deaths, especially among sheep, will be liable to occur.

The following rations are suggested :—

I.—1 part cotton cake.	II.—1 part mixture, as in I.
2 parts ground nut cake.	1 part linseed cake.
2 parts bran or dried grains.	

These mixtures may be used at the rate of about ½ lb. per head per day. As soon as the sheep get used to the roots, the cotton cake may be dropped and its place taken by an equal weight of bran or dried grains. The ration may be increased as the season advances.

Pigs.—As last month.

Imports of Grain in the Cereal Year, 1915-1916.

THE last two cereal years (1st September to 31st August, 1914–15 and 1915–16) practically coincide with the first two years of war, so that a comparison with previous cereal years of the figures showing the extent to which imports of grain from our Colonies and from foreign countries have supplemented the home harvest of 1915 is unusually interesting.

To begin with, the *wheat* crop of the United Kingdom which was available in 1915–16, viz., 9,239,400 qr. was the largest since 1898, being an increase of 1,435,000 qr. over that available in 1914–15 and of 2,152,000 qr. over that available in the last pre-war cereal year of 1913–14. The imports of wheat and wheat flour* into the United Kingdom amounted to 26,557,013 qr.† (of 480 lb.), these being greater by 543,853 qr. than the imports of 1914–15, and less by 364,207 qr. than those of 1913–14. Including the produce of the home wheat crop, the total estimated wheat grain available for home consumption was 35,796,410 qr. in 1915–16—a record figure—compared with 33,817,160 qr. in 1914–15, and 34,008,320 qr. in 1913–14. (In these amounts seed is included but not stocks carried over.) Thus, comparing the year just past with the year before the war, the increased home wheat crop more than sufficed to compensate for the decrease in imports; while, comparing the second year of war with the first, both the home wheat crop

* The wheat flour has been converted into its equivalent weight of grain on the assumption that 28 per cent. of the wheat is offal.

† It should be noted that the imports of articles of food include those which, at the time of their importation, were the property of H.M. Government or the Governments of the Allies. The re-exports of wheat and flour were, in 1915–16, only 406,170 cwt., and these figures would include purchases (if any) by, or on behalf of, the Governments of the Allies, but not, however, goods taken from British Government Stores and Depots, or goods bought by H.M. Government and shipped on Government vessels.

and the imports increased. An important point is that, even with the large home crop of 1915, three-quarters of our wheat supplies in 1915–16 were imported. Ten years' figures are given in the following table :—

Harvest Year.		Wheat Crop of the United Kingdom.	Imports of Wheat during the cereal Year, Sept. 1—Aug. 31.	Imports of Wheat Flour in equivalent weight of Grain.	Total Imported Wheat and Flour in equivalent weight of Grain.	Total estimated Wheat Grain available for Home Consumption (including seed).
		qr.	*qr.*	*qr.*	*qr.*	*qr.*
1906–7	..	7,577,300	22,105,180	4,284,490	26,389,670	33 966,970
1907–8	..	7,066,400	21,362,720	4,339,090	25,701,810	32,768,210
1908–9	..	6,741,200	21 727,220	3,554,650	25,281,870	32,023,070
1909–10	..	7,899,600	24,099,060	3,501,520	27,600,580	35,500,180
1910–11	..	7,074,200	23,516,140	3,263,380	26,779,520	33,853,720
1911–12	..	8,039,200	24,109,260	3,324,140	27,433,400	35,472,600
1912–13	..	7,175,300	26,500,565	3,648,883	30,149,450	37,324,750
1913–14	..	7,087,100	23,267,175	3,654,048	26,921,220	34,008,320
1914–15	..	7,804,000	22,483,587	3,529,573	26,013,160	33,817,160
1915–16	..	9,239,400	23,311,055	3,245,958	26,557,013	35,796,410

With regard to the countries from which the supply of wheat was drawn, the outstanding feature is the doubling of the imports from the United States between 1913–14 and 1915–16, the extra thirty-four million cwt. sent from that country having more than compensated for the decreases in the supplies from India, Russia, Argentina and Australia put together. Imports from Canada have remained steady, those in 1915–16 being the largest yet recorded from that country.

The price of home-grown wheat rose from an average of 49*s*. 9*d*. in 1914–15 to 53*s*. in 1915–16; during the year there was at first a fall in price from August to September, then a fairly continuous rise until 59*s*. 4*d*. was reached in the first week of March, from which date until the middle of July there was again a fall, except at the end of April. The average declared value of imported wheat rose from 50*s*. 10*d*. in 1914–15 to 56*s*. 7*d*. in 1915–16, *i.e.*, a rise of 12 per cent., as compared with a rise of 6·5 per cent. in the case of home-grown. The rise in price over the pre-war period, 1913–14, was 64 per cent., both for imported wheat and home-grown wheat.

British barley averaged 49*s*. per qr. (a rise of 16*s*. 6*d*. compared with the preceding year) while British oats averaged 30*s*. 11*d*. (a rise of 2*s*. 3*d*.). The value of imported barley was 42*s*. 3*d*. per qr. and of imported oats 29*s*. 4*d*. per qr., compared with 29*s*. 5*d*. and 29*s*. 3*d*., respectively, in the previous year. The rises compared with the pre-war period 1913–14 were: British barley 83 per cent., imported barley 75 per cent., British oats 62 per cent., imported oats 78 per cent.

The table on p. 593 shows the average prices of British

wheat, barley and oats ascertained under the Corn Returns Act in each of the cereal years since 1906–7. The quantities given in the table are the quantities returned as sold, from which the averages are calculated :—

Average prices of British wheat, barley and oats ascertained under the Corn Returns Act in each cereal year since 1906–7.

Harvest Years. Sept. 1—Aug. 31.	Prices per quarter.			Quantities sold at certain markets.		
	Wheat	Barley.	Oats.	Wheat	Barley.	Oats.
	s. d.	*s. d.*	*s. d.*	*qr.*	*qr.*	*qr.*
1906–7 ..	28 1	24 5	18 4	2,830,991	3,376,615	1,219,419
1907–8 ..	32 9	25 8	18 2	2,944,250	3,564,908	1,530,848
1908–9 ..	36 6	20 11	18 10	2,962,825	2,972,880	1,054,318
1909–10 ..	32 0	23 10	17 8	3,144,873	2,988,483	795,824
1910–11 ..	30 11	24 9	17 8	2,799,703	2,992,128	831,898
1911–12 ..	34 10	31 2	21 6	2,944,095	2,645,477	719,495
1912–13 ..	32 0	27 10	19 7	2,324,474	2,489,932	630,276
1913–14 ..	32 4	26 10	19 1	2,740,702	3,438,159	850,308
1914–15 ..	42 9	32 6	28 8	3,164,978	3,132,773	1,244,465
1915–16 ..	53 0	49 0	30 11	3,676,101	2,251,515	1,219,941

The aggregate imports of the principal cereals in each of the past ten years are given below :—

Harvest Year.	Millions of cwt.				
	Wheat.	Wheat Meal and Flour.	Barley.	Oats.	Maize.
1906–7 ..	94·7	13·2	19·5	10·9	51·7
1907–8 ..	91·6	13·4	17·5	13·2	39·5
1908–9 ..	93·1	11·0	22·0	15·5	39·0
1909–10 ..	103·3	10·8	19·9	19·6	34·6
1910–11 ..	100·8	10·1	20·1	16·6	46·0
1911–12 ..	103·3	10·3	21·9	18·4	32·1
1912–13 ..	113·6	11·3	22·4	20·0	49·5
1913–14 ..	99·7	11·3	21·2	15·4	40·2
1914–15 ..	96·4	10·9	12·7	15·4	48·0
1915–16 ..	99·9	10·0	17·8	13·3	37·3

The Dairying Industry of England and Wales.

WITH the present number of the *Journal* is published Supplement No. 16, consisting of two papers which, together, constitute a valuable survey of the dairying industry in England and Wales. These articles are the outcome of a request for information on the dairying industry received some months ago from the agricultural department of the University of Oregon, and were written at the request of the Board with the object of furnishing a conspectus of the industry in this country. The author of the first paper, Mr. W. Gavin, was connected for some years with one of the leading agriculturists and dairy farmers in England and, latterly, was in charge of

the home farms of a large landed proprietor. The author of the second paper, Mr. J. Mackintosh, first at the South-Eastern Agricultural College, Wye, and then at University College, Reading, has devoted some years to the study of dairying problems.

I. The first paper opens with an historical survey of the dairying industry in the last half century, and draws attention to the rapidly increasing volume of the fresh milk trade.

It is shown that the number of cows and heifers in England and Wales increased from 1,952,648 head in 1881-5 to 2,484,220 head in 1914, but that this increase did not keep pace with the increase in the population of the country, the increase in the latter having been, since 1871, some 60 per cent., as against some 30 per cent. in the former. It is interesting to note that cows and heifers have not increased at the expense of other cattle; they have increased at a very much greater rate during the last decade, but before 1896 the increase was at the same rate for both classes of stock. A further point is that, in spite of the great increase in the total number of cows in all districts there has not been during late years any "levelling-up," but that the actual tendency has been to increase the number in those districts where it was already large at a greater rate than in those districts where the density was less; in other words, the greatest increase in dairying has occurred in dairying districts.

The author next deals with the railway milk traffic of the various railway companies, with special reference to the London milk trade. The figure obtained for the total railway milk traffic of London is 91,700,000 gal., and this, added to a road traffic of 15,000,000 gal., and the produce of London dairies, 1,200,000 gal., gives the total milk supply of London as approximately 108,000,000 gal. The midland towns of Lancashire, Cheshire, Warwick, Stafford and the West Riding take something over 50,000,000 gal., the North-East Coast takes 11,000,000 gal., the South Wales mining area 4,000,000 gal., the South-East Coast and district, 4,500,000 gal., and the South Coast, 5,750,000 gal. With 92,000,000 gal. taken to London, and 100,000,000 gal. elsewhere, the total handled by English railways does not exceed 200,000,000 gal. Estimates are quoted, giving the total consumption of milk as 731,000,000 gal. in 1908, so that about one quarter of the milk consumed in England and Wales is transported by railway. Many consignments are made from great distances, *e.g.*, in 1911 the G.W.R. brought 1,549 churns from St. Erth, Cornwall, 320 miles to London, while the most distant point recorded by the L. & N. W. R. for London milk traffic is Toom (Ireland), 513 miles from Euston Station. A valuable summary of the railway

traffic is given in an appendix in which the principal consuming and producing areas of the various lines are shown where possible.

The share taken in the industry by the various counties, and the conditions obtaining in these counties are next considered. It is emphasised (1) that the basis of dairying in this country is now the fresh milk trade; (2) that cheese-making, though still carried on in some districts, is, generally speaking, only continued (*a*) in districts where lack of transport encourages it, or (*b*) as a means of utilising a surplus or flush of milk when prices are low; (3) that butter-making, with the exception of that in the Cornish factories, is a rapidly diminishing industry in England and Wales.

On the basis of the figures given in the Board's report on the agricultural output of Great Britain, the total milk production of England and Wales is placed at 1,071,000,000 gal. With regard to the consumption of milk, that for the whole of England and Wales is placed at 22½ gal. and that for London at 15 gal. per head.

The paper concludes with a survey of the imports and exports of dairy produce.

II. Mr. Mackintosh's paper deals with the average costs, not merely of food in the production of milk, but also of various overhead charges and transit charges, the former including charges in respect of labour, depreciation (on live and dead stock), interest on capital and keep of bull; and in connection with the cost of food due attention has been paid to the value of the manurial residues of the foods consumed. The farms to which the investigation related were situated throughout the county of Bucks, and in parts of the counties of Berks, Oxford and Middlesex.

Throughout the paper the costs are given for three different types of farms, *viz.*: Class 1—Suburban farms; Class 2—Farms almost entirely grass land with very little arable; Class 3—Farms chiefly grass land, but with a fair acreage of arable. The author also mentions a fourth class—chiefly arable—but does not give figures of costs. It is, perhaps, unfortunate that the materials for investigating the cost of production on this class of farm are not so abundant as in the case of the first three classes. The advantages of arable dairying accompanied by catch cropping are at present being much discussed by agriculturists, and a fuller investigation would yield interesting results.

The following table shows, for the three types of farms, the gross cost of food, the value of the manurial residue and the net cost of food.

2 R 2

Value of Manurial Residue and Gross and Net Cost of Food.

—	Per Gallon of Milk (10·3 lb.).			Per 100 lb. of Milk.			Per 1 lb. of Butter-Fat.		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Gross Cost of Food	4·83	3·72	4·14	46·89	36·11	40·19	12·34	9·50	10·58
Value of Manurial Residue ..	·35	·26	·38	3·40	2·52	3·69	·90	·66	·97
Net Cost of Food	4·48	3·46	3·76	43·49	33·59	36·50	11·44	8·84	9·61

The division of the gross cost of food between the various kinds of foods is as follows :—

	Roots. *per cent.*	*Hay.* *per cent.*	*Straw* *per cent.*	*Wet Grains.* *per cent.*	*Cakes & Meals.* *per cent.*	*Pasture & Aftermath.* *per cent.*
Class 1-	17·8 ..	13·4 ..	7·6 ..	12·5 ..	30·3 ..	18·4
Class 2	12·5 ..	23·2 ..	6·2 ..	— ..	35·0 ..	23·1
Class 3-	16·6 ..	15·5 ..	6·2 ..	— ..	45·2 ..	16·5

The following is a summary of the overhead charges :—

Summary of Overhead Charges.

—	Per Gallon of Milk (10·3 lb.).			Per 100 lb. of Milk.			Per 1 lb. of Butter-Fat.*		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
1. Labour	1·60	1·30	1·42	15·53	12·62	13·78	4·09	3·32	3·62
2. Depreciation and Loss ..	1·47	·37	·73	14·27	3·59	7·09	3·75	·94	1·86
3. *Interest on Capital*	·42	·36	·39	*4·07*	*3·49*	*3·78*	*1·07*	·92	*1·00*
4. Depreciation of Dairy Utensils and Food Machinery; Oil and Coal, Veterinary Charges, Medicine and Sundries	·37	·31	·36	3.59	3·01	3·49	·94	·79	·92
5. Keep of Bull	·22	·18	·20	2.13	1·74	1·94	·56	·46	·51
Total	4·08	2·52	3·10	39·59	24·45	30·08	10·41	63·4	7·91

* These figures are reckoned on the basis of a fat-content of 3·8 per cent.

and the following is a summary of the transit charges :—

Summary of Transit Charges.

—	Per Gallon of Milk.			Per 100 lb. of Milk.			Per 1 lb. of Butter Fat.		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
1. Keep and Depreciation of Milk Cob, Upkeep of Milk Cart, Railway Churns, &c.	·21	·44	·42	2·04	4·27	4·08	·54	1·12	1·07
2. Railway Carriage	—	1·04	·78	—	10·10	7·57	—	2·66	1·99
Total	·21	1·48	1·20	2·04	14·37	11·65	·54	3·78	3·06

If the overhead and transit charges are added to the net cost of food shown in the first table, the figures arrived at for cost of production to the farmer are: *Per gallon of milk*, Class 1, 8·78*d.*, Class 2, 7·46*d.*; Class 3, 8·06*d.* *Per* 100 *lb. of milk*: Class 1, 85·12*d.*; Class 2, 72·41*d.*; Class 3, 78·23*d.* *Per* 1 *lb. of butter fat*: Class 1, 22·39*d.*; Class 2, 19·05*d.*; Class 3, 20·58*d.*

The average yields per cow were: from farms in Class 1, 650 gal.; Class 2, 640 gal.; Class 3, 660 gal.

In working out the above costs no charge was made for the supervision by the farmer or bailiffs.

The paper concludes with a brief summary of the results obtained by other investigators.

It should be distinctly understood that *the figures relate to pre-war conditions*, and since they are based on a small area, they cannot be regarded as of universal application. The paper is chiefly valuable in that it contrasts the results on different types of farms, analyses the costs into various headings and supplies farmers with a method by which they can work out their own costs, and thus examine their practice closely where they find their costs exceeding the average figures given in the paper.

The Importance of Producing Cheese.

SOME experiments on cheese-making carried out in the dairy at the Manchester Show, 1916, of the Royal Agricultural Society possess considerable interest at the present time.*

Cheese v. Butter.—To show that the manufacture of cheese brings a better return than butter-making, where milk containing 3·0 to 3·5 per cent. of fat is used, 10 gal. of Shorthorn milk, after being thoroughly mixed, were divided into two equal lots of 5 gal. One lot was passed through a separator, the cream being subsequently churned, while the other was used for making a No. 1 Small Holders' Hard Cheese.†

The butter produced weighed 1 lb. 14½ oz., while the cheese reached 6 lb. 14¼ oz.; from the latter weight, however, an allowance of 12½ per cent. should be made for shrinkage, as the cheese would not be ready for consumption for three weeks or thereabouts; this allowance would reduce the weight of marketable cheese to (say) 6 lb.

* *Report of the Steward of Dairying, Manchester Show*, 1916. Roy. Agric Soc., 1916. Price 6*d.*

† For description, see the Board's Leaflet No. 231.

Taking the value of the whole milk at 10*d.* per gal., the separated milk at 2*d.* per gal., butter at 1*s.* 6*d.*, and cheese at 1*s.* per lb., the following difference in value will be apparent :—

	s.	*d.*	*s.*	*d.*
5 gal. milk, valued at 4*s.* 2*d.*, produced cheese valued at ..			6	0
" " " butter "	2	10¼		
plus 5 gal. separated milk ..	0	10		
			3	8¼

showing an extra profit on making cheese of 2*s.* 3¾*d.* on 5 gal. milk, or about 5½*d.* per gal.

Small Hard Cheeses.—As there is at present a large demand for hard cheese, small cheeses weighing from 1 lb. to 6 lb. were made to show (1) that it is possible to make a comparatively small quantity of milk into cheese, (2) that the process requires only few and inexpensive materials, (3) that the process is a simple one.

The particular cheeses made at Manchester were *Small Holders' Cheeses Nos.* 1 *and* 2 (see Leaflet No. 231), the *Kingston Cheese* (see this *Journal*, June, 1911, p. 193) and the *Hutton, Wensleydale* and *Small Lancashire Cheeses.* The selling price of each varies with the age and quality of the cheese, ranging from 1*s.* 1*d.* to 1*s.* 6*d.* per lb. All these cheeses should be ready to sell in from three to four weeks after being made.

Cheese Mixture.—To show how easily a hard cheese may be used up, small jars of this mixture were made up in the dairy, the only implements used being a mincing machine, an ordinary earthenware basin and a spoon.

In conjunction with the above notes the Board's Special Leaflet No. 41, *The Importance of Producing more Cheese*, should be read.

Broom-rape.

In the article on the parasitic weed Broom-rape (*Orobanche minor*, Sutt.) which appeared in last month's issue of this *Journal*, p. 478, it was stated that the weed is not definitely known to be poisonous, though it has been suspected of having poisonous properties, and, according to Boitel, is liable to cause violent colic when it occurs in considerable proportion in clover and is ingested with it. In this connection Mr. R. G. Stapledon, M.A., Lecturer in Botany at the University College of Wales, Aberystwyth, has brought to the Board's notice a case in which *O. minor* had this season completely overrun the aftermath on a farm near Fishguard.

Mr. Stapledon had been asked to identify the plant "which the cattle devoured with apparent relish." He suggested that school children might possibly be engaged to collect the flowering stems and destroy them before the seed was distributed. In reply, the farmer wrote: "In going through the field to-day I cannot see a trace of the Lesser Broom-Rape; the cattle have cleared it all off." On further inquiry he stated that he had seen no trace of colic or other ill effects. There was a lot of the plant at first, and 2-year-old cattle enjoyed it and cleared off most of it in a few days after being turned in. In this case at least, therefore, Broom-rape appears to have proved harmless.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

Cost of Motor Ploughing (*Jour. Roy. Agric. Soc.*, 1915; *Arthur Amos*).—Estimates are made of the cost of motor ploughing: (*a*) by a *tractor*, viz., Saunderson and Mills' Model G., 20-h.p. engine, and (*b*) by a *motor plough*, viz., the Wyles Motor Plough. These estimates do not make any allowance for the depreciation of engine or the cost of repairs, since experience has not been sufficient to enable these to be accurately gauged; interest on capital is also excluded. The figures were supplied by farmers who are using the machines and have had satisfactory results.

Motor Tractor.

	1	2	3
Soil	Keen limestone (light).	Heavy Clay.	Heavy Clay.
Depth of ploughing	4–5 in.	5–6 in.	6 in.
Labour costs (per day)—	*s. d.*	*s. d.*	*s. d.*
1 engine driver	4 0	4 0	3 0
1 ploughman	2 6	4 0	3 0
Gratuities of 3*d.* per acre to each man	3 0	—	—
Oil costs per day—			
Paraffin	10 11	12 11	7 10
Lubricating	2 11	2 9	2 10
Petrol	0 3	0 6	0 6
Total Cost per day	23 7	24 2	17 2
No. of working hours per day	8	8	7
Acres per day	6	5	3
Cost per acre	3*s.* 11*d.*	4*s.* 10*d.*	5*s.* 9*d.*

In the above table, No. 1 refers to spring ploughing in March on light land in Gloucestershire with a 3-furrow plough; No. 2 to autumn ploughing in October on dry, heavy clay land in Bucks with a 3-furrow plough; No. 3 to autumn ploughing in November on rather wet, heavy clay land in Hunts with a 3-furrow plough. Assuming a 1914 price of £325, a life of 6 years and repairs amounting to £10 per annum, a charge of £72 9*s.* 2*d.* or 12*s.* 1*d.* per day (120 working days) will have to be added to the above costs. This will give total costs per acre of 5*s.* 11*d.* for farm No. 1 and 9*s.* 9*d.* for farm No. 3.

Motor Plough.

	4	5
Soil	Loam.	Heavy Loam.
Depth of Ploughing	5 in.	6 in.
Labour cost per day—	*s.* *d.*	*s.* *d.*
(1 driver)	4 0	4 0
Oil costs per day—		
Petrol	7 6	4 4½
Lubricating	2 1	1 4½
Total cost per day	13 7	9 9
No. of working hours per day	8	7¾
Acres per day	2¾	1¾
Cost per acre	5*s.* 1*d.*	5*s.* 7*d.*

In both cases the plough was a two-furrow one.

Motor Tractor Demonstration at York (*Univ. Leeds, Bull. No.* 100).—The Yorkshire Agricultural Society, in conjunction with the University of Leeds and the Yorkshire Council for Agricultural Education, held a demonstration of motor tractors near York on November 4th and 5th, 1915. Two fields were used: (1) a heavy clay to medium loam, (2) a sandy loam. Heavy showers fell the day before the demonstrations, but the tractors had no difficulty in travelling over the surface. The tests were of an hour's duration.

The following are particulars of the land ploughed, the fuel consumed, and the cost of fuel per acre :—

	Land Ploughed (6 in. deep) per 10-hour day.	Fuel per acre.		Fuel Cost per acre.
		Petrol.	Paraffin.	
	acres.	*gal.*	*gal.*	*s.* *d.*
Fowler (motor plough), 10 cwt., 10 h.p., £158	2½	5	—	10 10
Universal, 58½ cwt., 20 h.p. £325	9	¼	3	3 2
Mogul, 50 cwt., 16 h.p., £272	5¾	—	3½	[2 11]
Mogul, 91 cwt., 25 h.p., £432		No records.		
Overtime, 39 cwt., 24 h.p., £231	5¼	—	2	1 8
Sandusky, 81 cwt., 38 h.p., £577 10s.		No records.		
Daimler, 120 cwt., 40 h.p., £600	8½	2½	—	5 5
Mann (steam tractor) 95 cwt., 22 h.p., £465.	8½	1 cwt. coal.		1 6

Under normal conditions the price for petrol would be less than the 2*s.* 2*d.* per gal. here charged.

Except in the case of the Overtime Tractor and the Mann Steam Tractor the h.p. per £100 of price works out at about 6.

Tractor Trials at Stirling (*Trans. Highland and Agric. Soc.*, 1916).—The 16-b.h.p. *Mogul Oil Tractor*, using a two-furrow plough, did good rough ploughing on stiff clay, was easily handled, and was turned at the ends with great rapidity and in the space of an ordinary headland. On light land it did fair work on the level, but seemed incapable of ploughing to 8 in. going uphill. The tractor satisfactorily drove the threshing mill and hauled 5½ tons (gross) over a mile of road, including a gradient of 1 in 14, at about 3 miles an hour.

Mann's Steam Tractor did not show to advantage on the light land, but did very satisfactory work with a four-furrow plough on the clay. It drove the threshing mill and took a load of 6 tons (gross) over the road course.

The 40–45-b.h.p. *Sandusky Tractor* pulled a four-furrow plough controlled from the engine, so that only one man was required. The plough was unsuitable for the trial ground. The tractor threshed satisfactorily and hauled 6 tons on the road course.

The work of the 24-b.h.p. *Overtime Tractor* was also influenced by the fact that suitable ploughs were unobtainable. With a three-furrow plough on the clay very moderate work was done. On the less steep portion of the light land with a two-furrow plough it showed to better advantage. It drove the threshing mill satisfactorily and hauled 6 tons over the road.

The 11-b.h.p. *Wyles Motor Plough* did excellent work on both types of land. It required only one attendant took two furrows and was adjustable to various widths and depths. It was the only implement that succeeded with a two-furrow plough on the hill (gradient from 1 in 10 to 1 in 21) on the light land. It is not adapted for threshing or road haulage.

The land was in favourable condition and no appreciable packing of the soil by the wheels of the tractors was noticed.

OFFICIAL NOTICES AND CIRCULARS.

Parliamentary Questions and Replies on Agricultural Matters.

THE following questions relating to matters of importance to agriculturists have recently been asked in the House of Commons, and as the replies given to them are of general interest to agriculturists, they are printed here for their information :—

Returns from Planting Timber. — Mr. MacCallum Scott (3rd August) asked where any information can be found as to the obtaining of a profit in a less period than fifteen years by the planting of certain kinds of timber ; and whether any experiments in this matter have been or will be made on any of the woodlands owned by the Crown ?

Mr. McKinnon Wood : As I stated on the Committee stage of the Finance Bill on 12th July, when I was at the Scottish Office, I was advised that, under certain conditions, returns from planting timber could be obtained in less than fifteen years. I understand that, according to reliable information, poplar, Douglas fir, and Japanese larch will yield a return for pitwood at from ten to fifteen years. No experiments specially directed to this point have been made on woodlands under the Office of Woods, but I understand that arrangements for experimental planting with poplar are being made in Scotland.

Price of Wool.—Major Hunt (3rd August) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the fact that farmers have to pay full market price for their feeding stuffs, manures, and other necessaries, he is aware that there is dissatisfaction amongst them at the price of their wool being cut down by the Government below the prices of 1915 ; and whether he proposes to take any action in the matter ?

Mr. Acland : I am aware of the feeling among farmers to which the hon. and gallant Member refers. The Board of Agriculture has made repeated representations to the Army Council on the subject, and it was no doubt, after a consideration of them, that the concession in price, which was recently given, was announced. The hon. and gallant Member is not quite correct in stating that the farmers have to pay full

market price for their fertilisers, as I am informed that sulphate of ammonia makers have recently announced their willingness to sell sulphate to manure mixers and farmers at prices considerably below the ordinary market price likely to prevail for export, which represent an increase on average pre-war prices considerably less than that which the farmer will receive for his wool. I hope that farmers will take advantage of this position in placing their orders for sulphate in good time and for large quantities.

Sir A. Markham: Is the right hon. Gentlemen aware that the present price of sulphate of ammonia is £17 10s. a ton—that was what was recently charged—which represents an increase of 40 per cent. on the pre-war cost?

Mr. Acland: That is why I call attention to the fact that the makers are now offering it to farmers at £15 a ton up to 1st October, and £15 10s. for the rest of the season.

Major Hunt: Are they doing it all over the country?

Mr. Acland: Yes, I believe so—all the makers who are within what is called the Sulphate of Ammonia Association.

(See also "Sulphate of Ammonia" below.)

Purchase of Wool.—Sir John Spear (10th August) asked the Financial Secretary to the War Office if it is the intention of the Government to take the whole of a farmer's 1916 clip of wool if in sound condition, as is usual in ordinary sales, or will the dockings or any tied fleeces be rejected; and will the buyers be instructed to act in accordance with the usual custom in this respect?

Mr. Forster: The answer to the first part of the question is in the affirmative. In general, however, it is in the farmer's interest that dockings should be removed before the wool is sold, and licences will be given for the purchase and sale of dockings on application to the Army Contracts Department, Tothill Street, S.W., or to any of the district wool purchase offices. If the wool is sold by the farmer to the Department with dockings and tied fleeces, allowances will be required in accordance with a scale approved by the local Advisory Committee, of which three members are agriculturists and three are representative wool buyers.

Mr. Hume-Williams (21st August) asked the Secretary of State for War, with reference to the wool clip, whether he is aware that the practice before the war was that wool buyers visited farms, inspected the clip, and bought and paid in cash, and that the practice under the Government scheme has been altered by providing that the clip shall first be examined at the farms, 75 per cent. of the Government price paid within six days, the wool then sent to Bradford, and the remaining 25 per cent. paid after further examination; if he can state what is the object of this new procedure; and, seeing that the Government buyers are mostly those who formerly bought for themselves, whether he will consider the advisability of letting them buy out-and-out, as before, and thus save the cost of duplicate examination and the expenses of administration?

Mr. Forster: The practice with regard to purchasing wool before the War differed from district to district. The Government scheme follows existing customs as closely as the altered circumstances will allow. A great deal of the wool will be cased and stored locally, and final payment will then be made. The object of deferring final payment until the wool has been properly classed in a warehouse is to ensure that,

on the one hand, the farmers obtain the proper cash value of their wool, and, on the other hand, that the Government secures full value for its money.

Sir F. Banbury: Can the right hon. Gentleman say when we are likely to have our wool bought? My wool has been in my granary since 2nd June, and I have heard nothing more of it. Will it have to remain to the 2nd June next year?

Mr. Forster: I hope not. I can assure my right hon. Friend that large purchases are being made both in this country and in Ireland. It is naturally taking time to get the scheme into full working order. I hope that the wool of my right hon. Friend, as well as that of all other farmers, will be purchased before very long.

Mr. Leif Jones: Will interest be paid to the right hon. Baronet on the value of his wool during the period he is waiting?

Mr. Forster: Yes, my right hon. Friend, like all other farmers, will be paid as from the 1st August.

Mr. Field (21st August) asked the Financial Secretary to the War Office whether he can state when it is intended to take delivery of wool in Great Britain and Ireland; whether he is aware that difficulty of transit will arise if the wool is not moved before the Colonial imports arrive and are put on the railways for transport; and whether he is aware that deterioration of quality may be consequential in certain cases where proper storage facilities are not available?

Mr. Forster: With regard to the first part of the question, wool is already being purchased generally in Ireland, and in large quantities in Great Britain. Delivery is of course being taken. The Department is fully alive to the need for avoiding congestion on the railways to which attention is drawn in the second part of the question, and it is anticipated that the bulk of the English clip will have been transported before arrivals of Colonial wools assume large proportions. Any farmer who has reason to anticipate that his wool may deteriorate in quality owing to inadequate facilities for storing should immediately communicate with the deputy executive officer for his area, whose address is given on the census form which has been supplied to him.

Mr. Orde-Powlett (23rd August) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the difficulty and uncertainty that will arise in the event of wool from different farmers becoming mixed in the warehouses, he will arrange that all wool be sold, weighed, and paid for on leaving the owners' premises?

Mr. Forster: The course suggested in my hon. Friend's question has been carefully considered, but I fear it is impracticable.

Swine Fever. — *Serum Treatment and Importance of Prompt Notification of Disease.*—Sir John Spear (3rd August) asked the Parliamentary Secretary to the Board of Agriculture if he will give the number of outbreaks of swine-fever in England and Wales during the six months ending 24th June, 1916, and the number for the corresponding period of 1915; and is he satisfied with the result of the serum treatment of the disease?

Mr. Acland: The numbers are 2,538 and 2,306, respectively—an increase of 232. There is no evidence to connect this increase with the use of serum, and the results so far obtained are not sufficient to enable a definite statement as to the effects of the serum treatment to be made. There is, however, no doubt that when the owner sends prompt notice of the suspected existence of disease so that the treatment may be given

before the disease gets hold of his herd, serum has had a marked effect in the saving of pig life.

Owners will, therefore, be acting in their own interest and in that of *the country if they will always make the earliest possible notification when disease is suspected.*

Maintenance of Home-grown Food Supplies.—The attention of Members of the War Agricultural Committees and the Board's Representatives before the Appeal and Local Tribunals in England and Wales is directed to the following answer which was given by the Prime Minister to a question in the House of Commons on the 9th August, 1916.

Representatives should not hesitate to bring this important announcement to the special notice of the Tribunals :—

Mr. George Lambert, M.P., asked the Prime Minister whether, as a large number of exemptions of agricultural labour for military service will expire soon after the coming harvest, he will define, for the guidance of the Tribunals, the policy of the Government as to the necessity for maintaining for next year the highest possible output of Home-grown food supplies ?

The Prime Minister (Mr. Asquith) : **The policy of the Government in this matter remains the same as that which I stated in answer to a question in this House on the 11th of May last.***

Mr. Lambert : Does that apply to next year as well as to this year ?

The Prime Minister : **Yes.**

* On the 11th of May, 1916, the Prime Minister stated :—

> **"I can only repeat with emphasis that the Government hold that the "Maintenance of the Highest Possible Output of Home-grown Food "Supplies remains a national object of a most essential nature, and that "labour which is essential and irreplaceable should be retained on the "land for this purpose. The Military representatives and members of "Tribunals should be in possession of Regulations and Instructions which "should ensure the carrying out of this policy."**

Mr. George Lambert (16th August) asked the Secretary of State for War if he will direct the military representatives appearing before the Tribunals to act on the spirit and letter of the Prime Minister's declaration that both for this year and next the highest possible output of Home-grown food supplies remains an essential object of the first importance for the security of Great Britain ?

Mr. Forster : I can assure my right hon. Friend that military representatives are working in accordance with the agreement come to between the War Office and the Board of Agriculture. The importance of this question is fully realised, and the instructions issued to Tribunals by the Local Government Board are perfectly clear.

Mr. Lambert : Is the hon. Gentleman aware that in many cases the agreement reached by the War Office and the Board of Agriculture is not being adhered to by these local Tribunals ?

Mr. Forster : No, Sir, I am not. If my right hon. Friend will bring any case he has in mind to my notice I will inquire into it.

Mr. Outhwaite : Is the hon. Gentleman aware that the Tribunals in some cases refuse to take any notice of the representations of the military representative ?

Mr. Forster : I am not aware of that.

Mr. George Lambert (16th August) asked the Parliamentary Secretary to the Board of Agriculture if he is aware that in a number of cases the military representatives have refused to act on the

recognised scale agreed on between the War Office and the Board of Agriculture as to the minimum number of men required on farms; and whether, in view of the Prime Minister's announcement of the Government's policy that the highest possible output of Home-grown food supplies is an essential object of national importance, he will take steps to ensure that military representatives observe the agreement arrived at between the two Departments?

Mr. Acland: I have not heard of any cases in which military representatives have refused to recognise the scale referred to as a guide for their action and that of the Tribunals. If my right hon. Friend knows of such cases and will communicate them to me, I am sure that the War Office will be most anxious to look into them. As he will realise, the scale, owing to the great variety of agricultural conditions, cannot be regarded as a hard and fast rule to be applied to every case. It was agreed to as a general guide to the Tribunals and is, I believe, being so observed.

Captain Charles Bathurst (23rd August) asked the Secretary of State for War if he is aware that several thousands of regular farm workers have been exempted from military service by local and appeal tribunals until the end of the corn harvest or Michaelmas Day, but not afterwards; and whether, in view of the apprehension entertained by farmers throughout the country as to the possibility of ploughing and cultivating their arable land in the forthcoming autumn after their farm servants usually so employed have joined the Colours, and the threatened consequent reduction of the area sown with wheat and winter oats, he will give instructions to the tribunals to permit a further extension of time in the case of farm workers until after autumn cultivations and sowings have been completed, in all cases where it can be shown that this work cannot reasonably be carried through in their absence?

Mr. Forster: The gravity of the situation is appreciated. Instructions have already been issued to tribunals with regard to it, but I will see if further instructions are necessary.

. . . .

Captain Bathurst: Does the hon. Gentleman realise that, although these instructions may have been issued, the appeal tribunals in many cases have certainly not been acting on those instructions?

Mr. Forster: That is one of the things I want to look into.

Petrol for Agriculturists.—Mr. Carew (9th August) asked the President of the Board of Trade whether any restrictions are now being placed on the use of petrol for oil engines by agriculturists . . . and, if so, to what extent?

Mr. Harcourt: It is found necessary at present to restrict licences for supplies in these cases to 60 per cent. of the requirements.

Mr. Peto (10th August) asked the President of the Board of Trade whether the case of farmers using petrol to drive milking-machine engines has been considered; whether he will see that a sufficient supply of petrol for that purpose is allowed in all cases and a more adequate supply in the case of all other uses of petrol for agricultural purposes; and whether, in the case of farmers who through inadvertence or ignorance have not put in any claim for petrol he will allow claims put forward and substantiated during the present month to be considered?

Mr. Harcourt: Persons needing petrol for agricultural and industrial purposes receive licences for a larger proportion of their requirements

than most other classes of applicants. I hope that it may be possible to consider applications from farmers which are received out of time.

Maintenance of Milking Herds.—Captain Charles Bathurst (23rd August) asked the Parliamentary Secretary to the Board of Agriculture if he is aware that in the Midlands and in the South of England there is a tendency on the part of dairy farmers to dispose of their herds of milch cattle owing to the existing or anticipated shortage of milkers or owing to their reduced allowance of petrol for running a milking machine; and what steps the Board is taking in this matter in order to avoid a scarcity of milk during next winter?

Mr. Acland: The Board are aware of a tendency to dispose or to threaten to dispose of dairy herds for fear of shortage of labour, and some instances have occurred, but not at present to such a degree as to justify fears of a severe shortage of milk during next winter. The Board will continue to endeavour to help dairymen to retain their indispensable workers. Farmers should do their very best to obtain and train women for milking work, for I think it will pay them to maintain their milking herds, and it is certainly right to do so in the interest of the country.

Use of Soldier Labour in Agriculture.—Mr. Anderson (15th August) asked the Parliamentary Secretary to the Board of Agriculture whether he can remove the uncertainty that exists as to the terms on which farmers can obtain the temporary use of soldiers for harvesting or other urgent agricultural work; whether the soldiers thus released regain for the time being their civil rights or remain subject to military law; whether they are paid the harvesting wages of agricultural labourers or continue to draw their ordinary rates of pay as soldiers; whether there is any difference in amount between the money paid by the farmer for the use of these soldiers and the money actually received by the soldiers; and, if so what is the difference?

Mr. Forster: I do not think there should be any uncertainty. Full information has been issued by the Board of Agriculture and the War Office, and can be obtained at the local Labour Exchange. Soldiers allowed on furlough for agricultural work remain subject to military law. They are paid a special rate of harvesting wages. I think that I sent to my hon. Friend a copy of the relevant Army Council Instructions.

Mr. Lewis Haslam (15th August) asked the Secretary of State for War whether it is the duty of commanding officers in agricultural districts to cause a list to be made of such men under their command as are accustomed to agricultural work, so that the more suitable men may be engaged when required for agricultural and especially harvesting purposes?

Mr. Forster: In some cases commanding officers have been called upon by General Officers Commanding-in-Chief to prepare such lists, but the preparation of lists has not been ordered by the War Office. In all cases, as far as possible, men accustomed to farm work are sent out on agricultural furlough, but, as the supply does not meet the demand, no doubt inexperienced men have to be sent to make up the numbers asked for.

Captain Charles Bathurst (21st August) asked the Parliamentary Secretary to the Board of Agriculture if, out of 27,000 selected soldiers placed at the disposal of the farming community for harvesting operations application has been made by farmers for 3,000 only; whether he is aware that in some counties, where the County War Agricultural Com-

mittee is inactive, many farmers are still unaware of the availability and the method of obtaining soldier labour, and that in others the cumbrous machinery for obtaining such labour acts as a deterrent; whether arrangements can be made whereby farmers can at short notice *obtain the help of soldiers, and especially of their own former employees*, during the corn harvest now in progress by applying direct to commanding officers without the intervention of the Board, the County War Agricultural Committees, or the Labour Exchanges; and whether public notification on the subject can be made during the current week in the public Press?

Mr. Acland: Under the new arrangement, which was advertised in the Press on the 5th inst., applications were received by mid-day on the 9th inst. for 3,244 soldiers required to start work in the corn harvest for the period 14th to 26th inst. The number of men applied for for general purposes under the previous arrangement, which still continues, is largely in excess of that number and is increasing from day to day. It is *possible that some farmers are still unaware that soldier labour is* available, but as 33,089 soldiers were applied for through the Labour Exchanges during the period 3rd June to 28th July, which included many personal applications which could not possibly be granted, and 14,227 were supplied by the military authorities (a number which must have very considerably increased since then), it seems to me that the machinery has not been found to be too cumbrous, and that it has been working fairly well. The terms on which soldiers can be released were agreed with the War Office after careful consideration of all the circumstances, and it is not proposed to vary them, and while a farmer may apply for his son or one of his former men by name, there is no certainty that the man can therefore be allowed away, and it is much *wiser to make a general application. Frequent notifications on the* subject have been made through the Press and this will continue as occasion may require. The general position is that if farmers are still short of labour they should apply by the means which are in general quite well known to them. To scrap the machinery now, as the hon. and gallant Member suggests, would produce chaos.

Mr. W. Thorne: *Can the right hon. Gentleman say whether there is a scale of wages fixed for these particular soldiers working in the* harvest field, or are they paid ordinary soldiers' pay?

Mr. Acland: They are paid a rate equal to, and in the opinion of the farmers exceeding that usually paid for similar labour in harvest time.

Production of Nitrates by Water Power.—Mr. Haydn Jones (15th August) asked the Parliamentary Secretary to the Board of Agriculture whether the attention of the Government has been called to the fact that the United States proposed to appropriate a sum of $20,000,000 for the purpose of determining the best process, securing the necessary water-power, and erecting suitable plant for the production of nitrates; and whether the Government will appoint a committee to ascertain the possibility of utilising the water-power of Wales for this and kindred purposes.

Mr. Acland: The question of increasing the supplies of nitrates is being actively considered. It, however, appears doubtful whether our available water supplies are sufficient to make production by water-power the means best suited to this country. If my hon. Friend would come to the Board's Office and talk over the matter, I should be obliged. I have not received any particulars of the proposed action by the Government of the United States of America which he mentions.

Sugar for Fruit Preserving, etc.—Sir Walter Essex (16th August) asked Mr. Chancellor of the Exchequer whether he has been able to provide enough sugar to meet the requirements of fruit preservers, jam makers, etc.; or, if not, by what percentage does he estimate his shortened supply will necessitate their lessened purchases of the on-coming fruit crop of this year?

Mr. McKenna: Such arrangements have been made as will enable those who preserve upon a commercial scale to preserve the home-grown fruit up to their full capacity, provided that they pulp the fruit for which sugar is not immediately available and await the additional supplies which will be placed at their disposal later. These arrangements have been made in consultation with representatives of the preservers, and are, it is believed, quite satisfactory to the trade.

Purchase of Hay by the Government.—Mr. George Faber (16th August) asked the Parliamentary Secretary to the Board of Agriculture whether the Board of Agriculture holds a compulsory power of purchase over all hay in the hands of farmers in the country at a certain price; whether he can state for how long the power extends, so that farmers may know when they are free to sell hay which is not required for their own or for Government purposes; and whether hay bought by the Government is paid for as soon as the decision to buy is notified to the owner?

Mr. Forster: My right hon. Friend has asked me to answer this question. The power referred to in the first part of the question exists, but it is vested in the Army Council and not in the Board of Agriculture. This power will be exercised over all hay now standing or about to be harvested, but permission is being granted as rapidly as possible to farmers to sell any surplus over their own requirements and those of the Army. An advance payment of 50 per cent. is made within fourteen days of the notification of decision to buy, and 5 per cent. per annum interest will be paid on the balance of the purchase-money outstanding after the 31st October.

Mr. Faber: Does the Government fix the price or does it vary?

Mr. Forster: I think that the Government fixes a maximum price. It varies downward from that price according to scale.

Export of Malt and Barley.—Sir George Younger (16th August) asked the President of the Board of Trade whether the export of malt and barley is to be prohibited, and when public intimation of the fact will be made?

Mr Harcourt: The export of both barley and malt has been prohibited to all destinations abroad except British Possessions and Protectorates—barley by Proclamation dated 10th November, 1914, and malt by Proclamation dated the 3rd February, 1915.

Sir G. Younger: *Have any licences been allowed?*

Mr. Harcourt: Yes; a certain number of licences have been granted.

Import of Raw Phosphates.—Mr. Harry Hope (16th August) asked the Secretary for Scotland whether, in view of the shortage and consequently high prices of superphosphates, he will take steps to enable raw phosphates being imported from Algiers, so that this essential fertiliser shall be available for next season's crops?

Mr. Acland: I understand that the Ships Licensing Committee have promised to consider favourably applications for licences made by British shipowners for voyages with cargoes of phosphates to this country.

Sulphate of Ammonia.—Mr. Peto (21st August) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware that farmers are experiencing difficulty in obtaining supplies of sulphate of ammonia on the terms recently announced by the Board as having been offered by sulphate of ammonia makers; and what action the Government propose to take in the matter?

Mr. Acland: The Board have heard of a few cases of difficulty, and will be very glad to investigate any that are brought to their notice, if particulars of the quantity of sulphate of ammonia required, and the name of the producer or dealer to whom application was made, and the date when it was made, are sent to the Secretary of the Fertilisers Committee, at 3, St. James's Square, London, S.W. The Board have no reason to think that the arrangement accepted by the sulphate of ammonia makers, under which farmers will be able to obtain sulphate of ammonia at reasonable prices, is not being observed, but they would be bound to consider what action could properly be taken if it were found that makers were not allowing a fair proportion of their make to be used for agricultural purposes on the terms recommended.

Agricultural Shows and the Amusements Tax.—Mr. O'Shee (21st August) asked the Secretary to the Treasury, if he will state on what ground it was sought to levy the entertainments tax on the Dungarvan Agricultural Show; and whether the committee of the show have been or will be informed that their receipts are exempt from the tax?

Mr. McKinnon Wood: The tax is leviable on payments for admission to an agricultural show unless the Board of Customs and Excise are satisfied that exemption is allowable under Section 1 (5) of the Finance (New Duties) Act, 1916. In the case of the Dungarvan Show the committee claimed exemption under that provision, but the programme included items such as horse-jumping competitions, which were held by the Board to debar the show from the privilege of exemption, and they therefore informed the committee that the tax was leviable.

Treatment of Epizootic Abortion.—Sir John Spear (August, 1916) asked the Parliamentary Secretary to the Board of Agriculture if he will state the number of outbreaks of epizootic abortion in the county of Devon in each year since that county has been subject to a special Order dealing with the disease; whether the results of the operation of the Order in the opinion of the Board justify its retention; and, if so, whether they anticipate any development of their policy with regard to the treatment of this disease which will modify the position in the future?

Mr. Acland: The number of outbreaks of this disease in the county of Devon in the years 1912 (26th February to 31st December), 1913, 1914 and 1915, were 775, 1,039, 642 and 659 respectively. In reply to the second part of the question, it is true that the Order requires the isolation and detention of diseased animals and the cleansing and disinfection of diseased animals and the premises in which they have been kept, and, in so far, is doubtless of advantage, but the Board, as at present advised, are doubtful whether the cost of the administration of the Order to the local authority will be justified when the arrangements for the supply of vaccine for vaccination against the disease from the Board's laboratory to all applicants are completed. The Board hope that this will be at no very distant date, when they will inquire more fully into the working of the Devon Order, and advise the local authority as to the steps which they consider might best be taken then to deal with the disease in the county. A certain amount of vaccine

is obtainable at the present time on application to the Board's office, and there is no reason why Devon farmers should not avail themselves of it more than they do at present.

Rennet: Price and Substitutes.—Captain Charles Bathurst (23rd August) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware that the price of rennet for cheese-making is six times that obtaining prior to the war, is still rising, and is threatening to restrict the production of cheese in Cheshire, Wiltshire, and elsewhere; and whether the Board is taking any steps to acquaint cheese-makers with the value of possible substitutes and where they can be obtained?

Mr. Acland: The Board are aware that there has been a very considerable rise in the price of rennet, but, as it is still quite a small item in the cost of cheese-making, farmers do not, I think, make it the determining factor in deciding whether to make cheese or not. The Board have taken steps to increase importation of rennet, and have issued advice as to the preparation of home-made rennet in this month's *Journal*. The question of substitutes is under examination, but at present the Board do not think it desirable to advise the use of them.

Winter Oats.

IN view of the uncertainty of the spring oat crop in many parts of the country the Board of Agriculture and Fisheries desire to suggest to farmers, in suitable districts, who have not already grown winter oats, the desirability of giving winter oats a trial this autumn. In the southern and south-eastern counties, in particular, winter oats are, generally speaking, much more reliable than spring-sown oats.

Further particulars concerning winter oats will be found in the Board's Special Leaflet No. 36, and information as to the most suitable variety for any particular district may be obtained from the Agricultural Organiser at the County Education Offices, or from the head of the local Agricultural College, as outlined in Special Leaflet No. 25 (*Technical Advice for Farmers*). Copies of the leaflets may be obtained free of all charge on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Cultivation of Common Fields.

WITH reference to the Notice which appeared in this *Journal* for May, 1916, p. 197, as to the facilities afforded by the Inclosure Act, 1773, for the improvement of the method of cultivation of commonable arable fields, the Board have prepared the following Memorandum explanatory of the procedure prescribed by that Act for the purpose:—

1. A meeting of the occupiers of the common-field lands may be summoned by notice given in writing and signed by one-third in number and value of the occupiers. The notice should specify the time, place and object of the meeting and should be exhibited for at least 21 days at the entrances to the places of public worship in the parish and at any other places where notices are usually exhibited (Section 1 of the Act).

2. Before the date of the meeting, each occupier of lands in the common arable fields, if not the owner thereof, should obtain a written authority from the owner to enter into an agreement for the improving of the common fields (Section 25). These authorities will be produced

at the meeting. Provision for the case of an owner under disability is to be found in Section 22.

3. The promoters of the meeting should obtain beforehand the consent of the titheowner or titheowners to the making, by the occupiers, of such an agreement.

4. At the meeting, three-fourths in number and value of the occupiers of the common-field lands in the parish cultivating and taking the crops of the same may, with the consents mentioned in paragraphs 2 and 3 above, make rules, regulations and restrictions as to the manner in which the tillage or arable lands are to be ordered, fenced, cultivated, and improved by the respective occupiers thereof and as to the course of husbandry in which the said lands are to be kept, ordered and continued (Section 1). Such rules, regulations and restrictions will not remain in force for any longer term than 6 years or two rounds according to the ancient and established course of the parish (Section 2).

5. If the agreement by the occupiers provides that they shall not, during the time the rules, etc., are in force, exercise their rights of common pasture during the open periods and allots and sets apart what is deemed, by the majority of the persons who are entitled to such common rights but are not occupiers of the common fields, a sufficient and equivalent common for their exclusive use, such persons will be restricted to this allotted area, thus freeing the rest of the common fields from the common rights which hinder its cultivation in the most profitable manner. Except by means of such an arrangement commoners who are not occupiers of the common fields will not be deprived of their common rights except with their consent (Sections 8 and 9).

6. The Act also empowers the ploughing up, under certain conditions which are stated in Sections 11–14, of waste balks, slades, or meers.

Importation of Plants into France.

THE Board of Agriculture and Fisheries have been informed by the Foreign Office that the French Government have kindly consented to authorise until further notice the entry into France of all plants forwarded from England to British hospitals and cemeteries in France, although not accompanied by the certificates required under the Phylloxera Convention. When consignments of plants are being sent to France for other purposes consignors should be careful to make the necessary arrangements to procure the required certificates.

Special Reports on the Mineral Resources of Great Britain.

THE Board of Agriculture and Fisheries desire to give notice of the publication of a second edition of the first volume of the Special Reports on the Mineral Resources of Great Britain, which have been prepared by the Director of the Geological Survey in response to numerous enquiries that have arisen through the conditions brought about by the war.

In the main it is a reprint of the first edition, wherein the uses, distribution, treatment, and output of Tungsten and Manganese Ores are dealt with, and particulars of the mines, active and inactive, are given. Price 1*s*.

Copies may be obtained through any bookseller from Messrs. T. Fisher Unwin, Ltd., 1, Adelphi Terrace, London, W.C., who are the sole warehouse agents to the trade outside the county of London; or from the Director-General, Ordnance Survey Office, Southampton.

Agricultural Returns for England and Wales, 1916.

THE Preliminary Statement of the Agricultural Returns for England and Wales, collected in June last, shows an increase of 20,760 acres in the total area under crops and grass. In arable land there was an increase of 85,190 acres, largely in the place of permanent grass, which shows a decline of 64,430 acres.

As was expected after the very large increase last year, the area under wheat shows a reduction, the total area, 1,912,000 acres, being a quarter of a million acres less than in 1915.

Agricultural Returns of England and Wales, 1916: Preliminary Statement for 1916, compiled from the Returns collected on the 5th June; and comparison with 1915.

CROPS.

DISTRIBUTION.	1916.	1915.	INCREASE.		DECREASE.	
	Acres.	Acres.	Acres.	Per cent.	Acres.	Per cent.
TOTAL AREA (excluding WATER)	37,137,600	37,137,600	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (a)	27,073,860	27,053,100	20,760	0·1	—	—
ARABLE LAND	11,050,900	10,965,710	85,190	0·8	—	—
PERMANENT GRASS (a) — For Hay ...	4,827,210	4,651,610	175,600	3·8	—	—
PERMANENT GRASS (a) — Not for Hay	11,195,750	11,435,780	—	—	240,030	2·1
PERMANENT GRASS (a) — TOTAL ...	16,022,960	16,087,390	—	—	64,430	0·4
Wheat — Autumn Sown	1,787,230	2,029,310	—	—	242,080	11·9
Wheat — Spring Sown	124,890	140,860	—	—	15,970	11·3
Wheat — TOTAL	1,912,120	2,170,170	—	—	258,050	11·9
Barley	1,331,750	1,231,720	100,030	8·1	—	—
Oats	2,084,850	2,088,050	—	—	3,200	0·2
Rye	53,440	47,680	5,760	12·1	—	—
Beans	236,120	266,510	—	—	30,390	11·4
Peas	112,680	129,380	—	—	16,700	12·9
Buckwheat	3,300	2,650	650	24·5	—	—
Potatoes	427,910	463,400	—	—	35,490	7·7
Turnips and Swedes	938,060	931,860	6,200	0·7	—	—
Mangold	378,240	413,720	—	—	35,480	8·6
Cabbage	47,250	50,210	—	—	2,960	5·9
Kohl-Rabi	14,600	18,000	—	—	3,400	18·9
Rape	70,830	65,530	5,300	8·1	—	—
Vetches or Tares	89,110	109,630	—	—	20,520	18·7
Lucerne	54,270	53,000	1,270	2·4	—	—
Mustard	65,720	32,150	33,570	104·4	—	—
Brussels Sprouts	10,830	9,990	840	8·4	—	—
Cauliflower or Broccoli	8,600	7,840	760	9·7	—	—
Carrots	10,220	9,250	970	10·5	—	—
Onions	4,730	3,840	890	23·2	—	—
Celery	3,520	3,810	—	—	290	7·6
Rhubarb	6,850	7,050	—	—	200	2·8
Chicory	460	340	120	35·3	—	—
Flax	910	660	250	37·9	—	—
Hops	31,350	34,740	—	—	3,390	9·8
Small Fruit	73,240	74,190	—	—	950	1·3
CLOVER and ROTATION GRASSES. — For Hay ...	1,762,800	1,538,070	224,730	14·6	—	—
CLOVER and ROTATION GRASSES. — Not for Hay	827,610	824,300	3,310	0·4	—	—
CLOVER and ROTATION GRASSES. — TOTAL ...	2,590,410	2,362,370	228,040	9·7	—	—
OTHER CROPS	67,650	68,330	—	—	680	1·0
BARE FALLOW	421,880	309,640	112,240	36·2	—	—
ORCHARDS (b)	251,320	248,830	2,490	1·0	—	—

The total is, however, much greater than in recent normal years, and (except for 1915) is the highest since 1899. Barley shows a recovery of 100,000 acres from the low record of 1915; but oats show scarcely any change. Beans and peas show considerable reductions; the area under these two pulse crops being about seven-eighths of that returned in 1915. Potatoes and mangolds have both fallen off by some 35,000 acres, but turnips and swedes increased slightly. Among minor crops the chief alteration is in the acreage of mustard (whether for seed or fodder) which is more than double that of 1915. Although the area under permanent grass shows a decline, that portion reserved for hay shows a large increase, viz., of 175,000 acres; clovers and rotation grasses show an even greater increase, the total under this crop being 228,000 acres more than last year. Taking all categories of clover and grass, the increase in the area for mowing, as compared with 1915, is 400,000 acres.

All classes of horses show an increase, the total being over 72,000 more than in 1915; the greatest relative change is in the young stock under one year of age. Cattle show a rise of over 151,000, and the total number is the largest ever recorded in England and Wales. The increase is chiefly among the heifers in calf and the fattening cattle; cows in milk show a small decrease. All categories of sheep are more numerous than last year, the augmentation being 429,000. Pigs, on the other hand, show a drop of about 10 per cent., and are practically at the level of 1913.

LIVE STOCK.

KIND.	1916.	1915.	INCREASE.		DECREASE.	
	No.	No.	No.	Per Cent.	No.	Per Cent.
Horses used for Agricultural purposes (including Mares for Breeding) ...	772,770	729,080	43,690	6·0	—	—
Unbroken Horses (including Stallions). One year and above ...	227,170	209,770	17,400	8·3	—	—
Unbroken Horses (including Stallions). Under one year ...	109,810	99,240	10,570	10·7	—	—
Other Horses ...	249,820	249,090	730	0·3	—	—
TOTAL OF HORSES ...	1,359,570	1,287,180	72,390	5·6	—	—
Cows and Heifers in Milk ...	1,855,450	1,881,670	—	—	26,220	1·4
Cows in Calf but not in Milk ...	252,050	257,170	—	—	5,120	2·0
Heifers in Calf ...	322,180	295,660	26,530	9·0	—	—
Other Cattle:—Two years and above ...	1,067,770	994,330	73,440	7·4	—	—
,, ,, One year & under two	1,374,090	1,297,220	76,870	5·9	—	—
,, ,, Under one year ...	1,344,240	1,338,100	6,140	0·5	—	—
TOTAL OF CATTLE ...	6,215,780	6,064,150	151,630	2·5	—	—
Ewes kept for Breeding ...	7,047,110	6,871,740	175,370	2·6	—	—
Other Sheep:—One year & above	3,596,960	3,481,650	115,310	3·3	—	—
,, ,, Under one year ...	7,307,050	7,169,190	137,860	1·9	—	—
TOTAL OF SHEEP ...	17,951,120	17,522,580	428,540	2·4	—	—
Sows kept for Breeding ...	283,000	298,160	—	—	15,160	5·1
Other Pigs ...	1,884,940	2,121,870	—	—	236,930	11·2
TOTAL OF PIGS ...	2,167,940	2,420,030	—	—	252,090	10·4

PRELIMINARY Statement compiled from the Returns collected on the 5th June, 1916, showing the acreage under hops in each county of England in which hops were grown, with a Comparative Statement for the years 1915 and 1914.

Acreage of Hops, 1916.

COUNTIES, ETC.	1916.	1915.	1914.
	Acres.	Acres.	Acres.
KENT East	5,326	5,727	6,174
KENT Mid	6,467	7,238	7,004
KENT Weald	7,706	8,370	8,848
Total, Kent	19,499	21,335	22,626
HANTS	1,380	1,514	1,580
HEREFORD	4,645	5,405	5,507
SURREY	426	552	585
SUSSEX	2,656	2,864	3,036
WORCESTER	2,643	2,961	3,194
OTHER COUNTIES	103*	113†	133†
Total	31,352	34,744	36,661

* Gloucester and Salop. † Gloucester, Salop and Stafford.

MISCELLANEOUS NOTES.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for August, 1916, issued by the International Institute of Agriculture, contains estimates of the production of cereal crops in the Northern Hemisphere. The countries for which it is possible to give approximate estimates are as follows: In *Europe*—Spain, Italy, Switzerland; in *America* — Canada, United States; in *Asia*—British India, Japan; in *Africa*—Tunis.

Wheat—The total production in the aforementioned countries is estimated to amount to 197,283,000 qr. in 1916, against 264,323,000 qr. in 1915, the decrease being equal to 25·4 per cent., while the area sown shows a reduction of 11·5 per cent.

Rye—In the above-named countries, excluding British India, Japan and Tunis, the production is calculated to total 9,802,000 qr. this year, or about the same as last year, when it amounted to 9,810,000 qr., but the area under cultivation is smaller by 6·1 per cent.

Barley—The total production in the above countries, with the exception of British India, is placed at 52,599,000 qr. in 1916, as compared with 59,633,000 qr. in 1915, or a decrease of 11·8 per cent., but the area sown was greater by 2·2 per cent.

Oats—For the specified countries, excluding British India and Japan, the total yield is estimated at 182,547,000 qr. this year, against 222,544,000 qr. last year, or a decrease of 18 per cent., while the area sown was smaller by 1·8 per cent.

Maize—The production in the United States is estimated to amount to 334,270,000 qr. this year, or a decrease of 6·2 per cent. compared with last year, when the production amounted to 356,259,000 qr., while the area sown was rather larger.

France.—According to an official report, the condition of the crops on 1st August was as follows (August, 1915, figures in brackets): winter wheat, 64 (64); spring wheat, 62 (64); rye, 68 (66); maize, 68 (74); winter barley, 70 (68); spring barley, 72 (63); winter oats

73 (68); spring oats, 74 (65); and potatoes. 64 (62) (80 = good. 60 = fairly good). (*London Grain, Seed and Oil Reporter*. 21st August).

The preliminary estimate by the Ministry of Agriculture of the year's wheat crop gives a yield of 6,000,000 to 6,200,000 tons, as compared with 6,950,000 tons last year. (*London Grain, Seed and Oil Reporter*, 30th August.)

Russia.—H.M. Commercial Attaché, Petrograd, stated that according to the official "Trade Gazette" of Petrograd of 1st August, the total area under sugar-beet on 14th July was 1,667,079 acres or 194,802 acres less than last year. The condition of the sowings in general was considered fully satisfactory, 46 per cent. being good, 40 per cent. satisfactory, 8 per cent. unsatisfactory, and 3½ per cent. bad.

Canada.—According to a report, dated 1st September, received from the High Commissioner for Canada, a large quantity of wheat has already been cut in Manitoba, and the yields are greater than the pessimistic reports of a few weeks ago indicated even in the area affected by rust. Threshing reports have given yields of 10 to 18 bush. per acre. In Saskatchewan, harvesting is in full swing and a good average crop is expected. In Alberta, the weather conditions have been ideal and everything points to an excellent crop throughout the province. Oats and barley in all three provinces promise well as a whole.

A later report, dated 7th September, states that 80 per cent. of the wheat is cut in Manitoba and threshing is in full swing. 60 per cent. of other grains is also cut. In Saskatchewan cutting is general and threshing has been begun. In Alberta heavy yields of grain of good quality are expected all over the province.

United States.—The Crop Reporting Board of the Department of Agriculture, in reporting on crop conditions on 1st September, states that the total production of winter wheat is estimated at 455,000,000 bush., as compared with a yield of 655,045,000 bush. last season; spring wheat, at 156,000,000 bush., against 356,460,000 bush.; maize, at 2,710,000,000 bush., against 3,054,000,000 bush.; oats, at 1,231,000,000 bush., against 1,540,362,000 bush.; barley, at 184,000,000 bush., against 237,009,000 bush.; and linseed, 14,900,000 bush., against 13,845,000 bush. last year. (*Broomhall's Corn Trade News*, 9th September.)

Live Stock in France.—The numbers of farm stock on 1st July, 1916, are as follows (the corresponding numbers on 31st December, 1915, being shown in brackets): horses, 2,317,205 (2,156,424; cattle, 12,723,946 (12,514,414); sheep, 12,079,211 (12,379,124); pigs, 4,448,366 (4,915,780). (*Bulletin of Agricultural and Commercial Statistics*, August, 1916).

Agricultural Conditions in England and Wales on 1st September.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st September, state that the weather of August was generally favourable for nearly all crops. Fine and hot weather during the first fortnight helped to ripen the corn, while the rain during the last fortnight was badly wanted by the roots and pastures. Although the rain, which was heavy in some parts of England, delayed the harvesting operations, few reports of damage to the corn were received, while in some districts it was welcomed as a useful check to the corn which was ripening rather too rapidly.

Harvesting of corn made good progress in the south of England, except at the end of the month, and a commencement had been made in most parts, but comparatively little had been carried. Wheat shows scarcely any change during the month. Barley improved on the whole, but the quality may have been somewhat damaged by the wet. Oats are the poorest of the three cereals, though winter oats are good. All three corn crops are best in the north and in Wales. In the east, and also the south-west, some damage is reported from the wet, and some corn has sprouted. Beans maintain their promise to be over-average, but peas have fallen off somewhat.

Prospects for potatoes are satisfactory, indications pointing to the yield being just over average. Little disease is reported as yet, except in the south-west.

The weather has been very suitable for the roots; mangolds, after the spell of sunshine, made good growth; while turnips and swedes, which had been checked by the hot weather, grew well as soon as the rain set in. Hoeing has been rather neglected, and the yield is not likely to be above average in either case.

Apples and pears are both very small crops; while plums are below average, although they are about normal in the Worcestershire district.

Hops have deteriorated somewhat in Kent during the month, mainly owing to the attacks of red mould, which have been severe, and may lead to some yards being picked prematurely, or left unpicked; the yield will probably be from 5 to 10 per cent. below the mean. Elsewhere the mould is not so bad, and the prospects of a month ago for an average crop are about maintained.

Pastures have, in most districts, plenty of grass. They were getting bare by the middle of the month, and in most cases the wet weather was of great benefit, but in some parts the rain had not yet produced its full effect. Live stock have done well generally, except where the grass became very short.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on 1st September indicated probable yields which may be denoted by the following percentages:—Wheat, 97; barley, 99; oats, 95; beans, 101; peas, 97; potatoes, 101; turnips and swedes, 99; mangolds, 97; hops, 94.

Agricultural Labour in England and Wales during August.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st September, 1916, the supply of labour was short, but women and soldiers have been of great assistance in most parts of the country. No very great difficulty seemed to be feared in getting in the harvest, and the chief result of the deficiency has been the neglect of root-hoeing. Harvest wages were much higher than a year ago.

The following are details for the different districts:—

Northumberland, Durham, Cumberland and Westmorland.—Labour was still very scarce and the hay harvest was protracted in consequence.

Lancashire and Cheshire.—The supply of labour was still deficient but farmers, generally, had got through the work with the assistance of soldiers and women.

Yorkshire.—Labour was still difficult to obtain and wages were high Soldiers were being employed in some districts.

Shropshire and Stafford.—In Shropshire, although labour was short.

Derby, Nottingham, Leicester, and Rutland.—The position showed no improvement, but as men were being called away, women were taking their places, and soldiers have given valuable help.

Lincoln and Norfolk.—There was a shortage of labour, but not so serious as to prevent the work being done; women were helping to a considerable extent, and good use has been made of soldiers for the harvest. Harvest wages were quite 10 per cent. or more above last year.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was still deficient, but useful help was being given by women and soldiers.

Bedford, Northampton, and Warwick.—The deficiency was great, but soldiers and women have assisted in the hay harvest to a small extent.

Buckingham, Oxford, and Berkshire.—The labour supply was generally short. Female labour was being employed in most districts.

Worcester, Hereford, and Gloucester.—The scarcity was still marked, but assistance was being given by women and boys.

Cornwall, Devon, and Somerset.—Labour was short, but no fears were expressed that the deficiency will unduly delay harvesting.

Dorset, Wiltshire, and Hampshire.—The deficiency has not been felt so acutely as was at one time feared, as help has been given by women and soldiers.

Surrey, Kent, and Sussex.—Scarcity was still general, but necessary work has been done fairly satisfactorily on the whole.

Essex, Hertford, and Middlesex.—The supply of labour was still short, but up to the present it has been found sufficient for essential work.

North Wales.—The shortage has generally been met by military help and by the farmers assisting one another with the hay harvest.

Mid Wales.—Labour was short in some areas, but others reported no real scarcity; temporary help was difficult to get, but soldiers have been giving assistance.

South Wales.—Labour was very scarce, but farmers have been able to get necessary work done with some assistance from women and soldiers.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st September, 1916, certain diseases of animals existed in the countries specified:—

Austria (on the 2nd Aug.).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of July).—Anthrax, Foot-and-Mouth Disease (3 outbreaks), Swine Erysipelas, Swine Fever.

France (for the period 16th July—5th Aug.).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—31st July).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (month of July).—Anthrax, Foot-rot, Swine Erysipelas.

Hungary (on the 2nd Aug.).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 7th—13th Aug.).—Anthrax, Black-leg, Foot-and-Mouth Disease, (1079 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of July).—Anthrax, Blackleg, Swine Fever.

Rumania (for the period 6th—14th July).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of March).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (21,149 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of Feb.).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of July).—Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period 14th—20th Aug.).—Anthrax, Blackleg, Foot-and-Mouth Disease (8 "étables" entailing 8 animals, of which 1 "étable" was declared infected during the period).

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during August.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.	Rainfall. Amount.	Rainfall. Diff. from Average.	Rainfall. No. of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 5th Aug.:								
England, N.E. ...	62·9	+4·3	0·07	2	—16	1	8·6	+3·0
England, E.	64·4	+3·9	0·00	0	—12	0	9·5	+3·3
Midland Counties ...	64·5	+4·8	0·00	0	—14	0	8·9	+3·3
England, S.E. ...	65·1	+3·6	0·00	0	—12	0	11·1	+4·6
England, N.W. ...	62·6	+3·6	0·05	1	—19	1	7·7	+2·3
England, S.W. ...	64·2	+4·3	0·01	1	—16	1	9·5	+3·4
English Channel ...	65·3	+3·6	0·00	0	—13	0	11·2	+3·2
Week ending 12th Aug.:								
England, N.E. ...	60·2	+1·8	0·02	1	—14	1	6·4	+1·0
England, E.	62·2	+1·9	0·06	2	—10	1	6·7	+0·6
Midland Counties ...	62·7	+3·4	0·04	1	—13	1	6·4	+0·9
England, S.E. ...	63·6	+2·3	0·02	1	—11	1	6·5	+0·0
England, N.W. ...	61·8	+3·2	0·05	1	—19	1	8·3	+3·0
England, S.W. ...	62·4	+2·8	0·09	2	—15	1	6·5	+0·3
English Channel ...	64·2	+2·3	0.07	2	—12	1	8·3	+0·2
Week ending 19th Aug.:								
England, N.E. ...	60·2	+2·3	1·37	35	+20	6	2·7	—2·6
England, E.	62·2	+2·1	1·13	29	+15	6	3·8	—2·3
Midland Counties ...	61·1	+1·9	1·23	31	+16	6	3·1	—2·4
England, S.E. ...	62·2	+1·0	0·84	21	+ 7	5	4·7	—1·8
England, N.W. ...	59·5	+1·2	1·61	41	+21	6	3·0	—2·1
England, S.W. ...	60·9	+1·6	1·20	31	+12	4	4·6	—1·5
English Channel ...	62·7	+1·0	0·44	11	+ 4	3	6·3	—1·7
Week ending 26th Aug.:								
England, N.E. ...	59·9	+2·3	0·89	23	+ 7	4	4·0	—1·1
England, E.	61·1	+1·8	0·32	8	— 6	4	4·4	—1·5
Midland Counties ...	60·8	+2·3	0·50	13	— 4	4	4·4	—0·9
England, S.E. ...	61·7	+1·0	0·54	14	— 2	3	5·6	—0·7
England, N.W. ...	60·4	+2·5	0·65	16	— 7	4	4·5	—0·4
England, S.W. ...	61·1	+2·13	1·14	29	+ 7	4	5·4	—0·5
English Channel ...	63·3	+1·9	0·69	18	+ 1	4	6·9	—0·3

* 1 inch = 25.4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	25	25	373	418
Animals attacked	34	27	443	478
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	3	3	36	37
Animals attacked	4	3	89	66
Parasitic Mange:—				
Outbreaks	77	41	1,712	581
Animals attacked	132	84	3,831	1,263
Sheep-Scab:—				
Outbreaks	6	1	184	160
Swine Fever:—				
Outbreaks	254	245	3,296	2,992
Swine Slaughtered as diseased or exposed to infection	182	969	8,621	13,329

The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	—	3	1
Animals attacked	—	—	7	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	4	9	48	53
Sheep-Scab:—				
Outbreaks	24	22	278	290
Swine Fever:—				
Outbreaks	24	13	224	175
Swine Slaughtered as diseased or exposed to infection	201	90	1,384	1,000

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in August and July, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	August.		July.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	14 11	14 3	15 9	14 6
Herefords	14 2	12 10	15 2	13 11
Shorthorns	14 3	13 0	15 0	13 9
Devons	14 2	12 6	14 11	13 0
Welsh Runts	14 5	13 10	—	14 3
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	13½	12	13½	12
Sheep :—				
Downs	12¾	11¾	13	12
Longwools	11¾	10¾	12	11¼
Cheviots	13½	12½	14	12¾
Blackfaced	13¼	12¼	13¾	12¾
Welsh	12½	11¼	12¾	11¼
Cross-breds	12¾	11¾	13	12
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 8	12 0	12 5	11 10
Porkers	13 3	12 8	13 2	12 8
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	36 4	28 12	34 3	27 0
,, —Calvers ...	35 4	28 3	33 19	26 19
Other Breeds—In Milk ...	32 2	25 6	30 16	24 10
,, —Calvers ...	25 0	24 0	26 0	23 0
Calves for Rearing	3 11	2 15	3 16	3 0
Store Cattle :—				
Shorthorns—Yearlings ...	14 11	12 17	14 8	12 17
,, —Two-year-olds...	22 0	18 15	22 5	18 12
,, —Three-year-olds	29 6	24 10	28 13	24 17
Herefords —Two-year-olds...	23 7	19 2	21 16	18 16
Devons— ,,	21 12	18 11	22 5	18 16
Welsh Runts— ,,	24 7	19 17	20 3	18 7
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	55 0	46 0	53 2	43 9
Store Pigs :—				
8 to 12 weeks old	36 6	28 4	38 2	30 0
12 to 16 weeks old	56 7	44 7	58 1	46 5

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in August, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—						
English	1st	95 0	96 0	—	96 6	94 0
	2nd	91 6	94 0	—	89 6	91 0
Cow and Bull	1st	87 6	90 0	83 0	80 6	87 0
	2nd	80 6	81 6	71 0	75 6	79 6
Irish: Port Killed	1st	—	94 0	94 6	92 6	91 0
	2nd	—	91 0	87 6	86 0	87 6
Argentine Frozen—						
Hind Quarters	1st	87 6	—	—	—	—
Fore ,, ...	1st	69 0	—	—	—	—
Argentine Chilled—						
Hind Quarters	1st	94 6	94 0	94 6	95 0	94 6
Fore ,, ...	1st	69 0	67 6	67 6	67 6	67 6
Australian Frozen—						
Hind Quarters	1st	—	—	—	—	—
Fore ,, ...	1st	—	—	—	—	—
VEAL:—						
British	1st	110 0	—	—	113 0	—
	2nd	100 0	—	96 6	97 0	95 0
Foreign...	1st	—	—	—	—	—
MUTTON:—						
Scotch	1st	107 6	—	103 0	118 6	107 6
	2nd	98 6	—	96 0	111 6	102 6
English...	1st	109 0	112 0	—	112 0	102 6
	2nd	101 6	107 6	—	101 6	98 0
Irish: Port Killed	1st	—	—	96 6	102 6	102 6
	2nd	—	—	91 6	95 6	98 0
Argentine Frozen	1st	88 0	86 0	87 0	89 6	87 0
Australian ,, ...	1st	84 0	—	—	85 0	—
New Zealand ,, ...	1st	84 0	—	—	85 0	—
LAMB:—						
British	1st	111 6	120 6	115 6	124 0	119 6
	2nd	106 0	112 0	107 6	114 0	111 0
New Zealand	1st	95 6	98 0	95 6	93 6	95 6
Australian	1st	93 6	—	—	—	—
Argentine	1st	104 6	105 0	103 6	105 0	103 6
PORK:—						
British	1st	107 6	101 6	101 6	102 6	93 0
	2nd	102 6	97 6	94 6	93 6	85 0
Frozen	1st	—	82 0	—	84 0	—

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in August, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	18 6	17 6	—	—	19 0	18 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	179 0	175 0	179 0	175 6	178 0	173 6
" Factory	159 0	150 6	154 0	145 0	162 6	155 0
Danish...	—	—	193 0	190 0	193 0	189 6
French...	—	—	—	—	159 0	154 0
Dutch	—	—	—	—	171 0	168 6
Canadian...	177 6	175 6	—	—	175 0	171 0
Australian	162 0	160 0	—	—	—	—
New Zealand	177 6	173 0	—	—	180 0	176 0
Argentine	164 0	160 0	—	—	173 0	170 0
CHEESE:—						
British—						
Cheddar	110 0	102 0	111 0	105 0	108 6	101 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	103 0	98 0	110 0	103 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	97 6	94 6	97 0	93 6	97 0	94 0
BACON:—						
Irish (Green)	126 0	120 6	122 0	119 0	122 0	117 6
Canadian (Green sides)	112 6	109 6	111 0	108 0	111 6	107 6
HAMS:—						
York (Dried or Smoked)	160 0	156 0	—	—	159 0	153 0
Irish (Dried or Smoked)	—	—	—	—	149 6	143 6
American (Green) (long cut)	99 6	96 0	101 0	97 6	99 0	95 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	19 4	—	—	—	21 0	19 7
Irish	18 1	—	18 2	16 10	19 7	18 4
Danish	—	—	—	—	21 2	19 4
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
White Kidney ...	146 6	136 6	148 6	135 0	130 0	120 0
Other First Earlies ...	161 6	131 6	130 0	118 6	118 6	108 6
British Queen... ...	150 0	133 6	138 6	128 6	126 6	113 6
HAY:—						
Clover	—	—	212 0	156 0	152 6	143 0
Meadow	—	—	—	—	152 6	143 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	Wheat.			Barley.			Oats.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 8 ...	30 11	46 2	55 8	25 11	29 7	47 8	18 4	26 5	31 5
,, 15 ...	31 0	48 9	56 7	26 0	30 5	48 6	18 6	27 6	31 11
,, 22 ...	30 11	51 6	57 2	26 3	31 3	49 6	18 11	28 10	32 6
,, 29 ...	31 1	52 8	58 0	26 6	32 5	51 0	19 1	29 10	32 11
Feb. 5 ...	31 0	53 3	58 3	26 7	33 7	52 5	18 9	30 3	32 4
,, 12 ...	31 0	54 8	57 6	26 7	34 7	52 10	18 11	31 1	32 2
,, 19 ...	31 0	56 0	56 11	26 7	34 11	53 6	18 11	31 5	31 9
,, 26 ...	31 0	56 0	58 2	26 6	35 3	54 2	18 11	31 8	32 2
Mar. 4 ...	31 5	55 11	59 4	26 2	34 6	55 7	18 9	31 8	32 4
,, 11 ...	31 6	54 8	58 2	26 0	33 5	55 6	18 7	31 0	32 3
,, 18 ...	31 5	53 9	57 9	25 8	32 2	55 4	18 6	30 7	31 10
,, 25 ...	31 4	54 3	55 11	25 7	31 11	54 6	18 8	30 6	31 4
Apl. 1 ...	31 6	54 6	53 6	25 6	31 9	53 8	18 5	30 6	30 5
,, 8 ...	31 5	54 9	51 8	26 8	31 3	53 7	18 4	30 4	30 1
,, 15 ...	31 7	55 4	53 2	25 4	30 10	53 1	18 4	30 5	30 7
,, 22 ...	31 9	56 5	55 3	26 6	31 5	52 10	18 5	30 11	31 8
,, 29 ...	31 9	58 3	56 3	26 0	32 7	53 5	18 5	31 5	32 4
May 6 ...	32 2	60 5	55 7	25 6	33 3	53 1	18 9	32 4	32 10
,, 13 ...	32 7	61 7	55 5	26 3	34 0	53 5	18 11	32 5	33 1
,, 20 ...	33 0	62 0	55 0	25 10	34 1	52 10	19 0	32 8	33 0
,, 27 ...	33 9	61 11	54 7	26 1	34 8	52 9	19 4	32 7	33 4
June 3 ...	34 0	61 9	53 3	25 11	35 4	53 9	19 4	32 5	33 3
,, 10 ...	34 1	60 1	51 2	24 11	34 5	52 8	19 8	32 4	32 7
,, 17 ...	34 1	56 1	48 10	25 10	34 3	50 9	19 9	31 9	32 1
,, 24 ...	34 3	52 0	47 6	25 4	34 4	49 10	20 0	31 9	31 3
July 1 ...	34 4	49 5	46 3	24 6	35 3	49 1	19 9	31 1	30 10
,, 8 ...	34 2	50 1	46 3	24 9	34 7	45 6	20 0	31 6	30 8
,, 15 ...	34 1	52 7	48 11	24 2	35 8	47 5	19 10	31 6	31 6
,, 22 ...	34 0	53 10	51 6	24 7	35 10	48 8	19 9	32 1	32 3
,, 29 ...	34 2	55 3	53 5	25 9	36 1	47 2	19 8	31 1	32 5
Aug. 5 ...	34 9	55 4	55 1	25 2	35 7	46 1	19 1	31 5	32 9
,, 12 ...	40 3	55 2	56 7	29 4	37 0	46 11	25 1	31 7	31 2
,, 19 ...	38 9	54 3	58 1	29 10	39 4	48 0	24 3	31 4	30 8
,, 26 ...	36 2	51 11	59 0	30 3	38 3	47 1	23 5	30 0	31 6
Sept. 2 ...	36 5	45 3	59 4	30 6	38 1	48 5	23 9	26 10	30 5
,, 9 ...	37 10	43 0	59 3	29 11	37 11	51 7	23 11	26 8	31 1
,, 16 ...	38 3	42 9		29 5	39 0		23 8	26 4	
,, 23 ...	37 6	43 3		29 3	39 8		23 3	26 1	
,, 30 ...	37 1	43 5		29 1	40 4		22 9	26 5	
Oct. 7 ...	36 8	44 1		28 10	41 0		22 5	26 5	
,, 14 ...	36 7	45 9		28 8	42 3		22 4	27 1	
,, 21 ...	37 2	48 2		28 7	44 0		22 5	28 1	
,, 28 ...	37 10	50 3		28 3	46 2		23 7	29 1	
Nov. 4 ...	38 8	51 6		28 6	47 3		23 7	30 4	
,, 11 ...	39 8	52 8		29 0	47 5		24 8	30 11	
,, 18 ...	41 0	53 6		29 8	47 11		25 5	31 3	
,, 25 ...	41 11	54 2		30 3	48 7		25 8	31 1	
Dec. 2 ...	42 2	53 7		30 2	48 11		25 9	30 11	
,, 9 ...	42 1	52 10		29 11	47 10		25 9	30 4	
,, 16 ...	42 7	53 11		29 8	47 5		25 9	30 6	
,, 23 ...	43 3	53 10		29 9	47 2		25 11	30 7	
,, 30 ...	44 4	54 9		29 10	47 5		26 6	30 10	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of August, 1914, 1915, and 1916.

—	WHEAT.			BARLEY.			OATS.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London ...	36 6	54 0	58 5	29 4	40 11	49 2	24 1	31 11	32 6
Norwich ...	35 11	54 4	56 0	27 5	—	44 7	21 7	29 0	32 0
Peterborough	37 2	52 4	57 0	28 3	37 7	43 4	21 10	31 0	31 0
Lincoln ...	35 6	53 11	58 7	27 8	36 7	—	21 5	32 4	33 5
Doncaster ...	36 4	53 7	57 0	—	35 9	—	21 8	31 10	32 10
Salisbury ...	35 2	54 11	57 8	28 6	36 11	46 3	22 8	30 11	31 0

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Availability of Mineral Phosphates for Plant Nutrition, *W. L. Burlison.* (Jour. Agric. Research, 26 June, 1916.) [63.1672.]

Bracken: Life History and Eradication, *G. P. Gordon.* [63.259.] Methods of Applying Lime, *J. Hendrick* and *J. M. Smith.* [63.15.] (Trans. Highland and Agric. Soc., Scotland, 1916.)

Field Crops—

South African Drugs and Poisonous Plants. [63.348.] Cultivation and Utilisation of Sunflower, Niger, and Safflower Seed. [63.342.] (Bull. Imp. Inst., No. 1. January-March, 1916.)

Mindewertsberechnung bei Klee und Grassaaten, *M. Heinrich.* [63.1951.] (*Deutsche Land. Presse, 26 Januar, 1916.*)

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Rescue Grass (*Bromus Willdenowii*, Kunth). (Agric. Jour. S. Africa, May, 1916.) [63.33(*b*).]

Plant Diseases—

Zur Gasvergiftung von Strassenbäumen, *P. Ehrenberg* und *K. Schultze.* (Ztschr. Pflanzenkrank., XXVI. Band, Heft 2, 1916. [614.7.]

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Silver-Scurf of the Irish Potato caused by *Spondylocladium atrovirens*, *E. S. Schultz.* [63.24.] Woolly Pear Aphis (*Eriosoma pyricola*), *A. C. Baker* and *W. M. Davidson.* [63.27.] (Jour. Agric. Research, 5th June, 1916.)

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CHALKING: A USEFUL IMPROVEMENT FOR CLAYS OVERLYING THE CHALK.

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THROUGHOUT Hertfordshire, Bedfordshire, Surrey and other counties round London there occur large areas of stony clay soil lying on top of the chalk and forming a layer, varying in thickness from a few feet to 20 or 30 feet. The surface is undulating, but on the whole the undulations are gentler than in the case of the chalk below, so that one sometimes finds the chalk only 6 ft. from the surface while not many yards away it may be as far down as 30 ft; this is shown in the photograph (Fig. 1). The formation is known to geologists as the Clay-with-Flints, the name originating in the large number of flints present.

This soil used to grow considerable quantities of wheat. Hertfordshire, where it occurs more extensively than anywhere else, was called by Cobbett the granary of London. The yields are not heavy but they are reliable, and the straw is so good that an extensive straw-plaiting industry grew up round Luton, Dunstable, etc., and spread throughout the villages, giving employment to the women and children. A serious setback came in the 'nineties of last century, and the effect of the fall in wheat prices was aggravated by the displacement of home-made plait by foreign plait. As in other districts, recovery took place first on the lighter soils, the more gravelly or sandy tracts being taken up by farmers, often from the North, who introduced potato growing and occasionally took two crops in one season; elsewhere dairying was developed. These systems of farming, however, are not well suited to the heavier soil, which occupies a considerable area, and much of it is not well farmed; this soil still retains its wheat-producing capacity, and present conditions justify attempts at improvement.

The soil is a heavy loam, containing about 20 per cent. of true clay, and is kept workable only by the large proportion

of flints. It is apt to be wet and sticky all through the winter and spring, and it is not readily brought down to a satisfactory tilth for a seed bed. At any time it is apt to run together badly after rain and to form hard clods in dry weather. As already stated, wheat does well and winter oats are also successful, but there is more difficulty about spring corn, especially spring oats; swedes are apt to suffer from finger-and-toe, and clover sometimes does badly.

From time immemorial it has been known that a satisfactory improving agent in the form of chalk lay underneath, and could be got out by the simple expedient of digging for it; pits are sunk till the chalk is reached, and the chalk is then hauled out and spread over the surface of the land. Traces of these pits can be seen in almost every field, and builders come across them in situations pointing to a considerable age. The practice, indeed, was old even when mediæval writers described it, and its great antiquity may be gauged from its almost complete identity with the method described by Pliny as being in vogue among the Celtic tribes.* It has never gone out of use, and the "chalk drawers" have always had successors to whom they handed on the mysteries of the craft. Since the 'nineties, however, it has not been common, the reason being that London stable manure, artificial fertilisers and ground lime have been much more readily obtainable than before, so that the farmer was tempted to spend all his spare money on them. It should be emphasised, however, that neither stable manure nor artificials will take the place of chalk, and lime will only do it if applied regularly in the rotation, which is not usually the case. All experience shows that better results are obtained by spending part of the manure money on chalk or lime than by putting it all in London dung and artificials.

Method of Obtaining and Applying the Chalk.

The essential feature of the method is that the chalk is dug out from the field to which it is to be applied by sinking wells at convenient points. Generally speaking, the work is done as piece-work by the chalk drawers, who provide their own tackle, but occasionally a large farmer has the appliances himself and employs his own men, some of whom, moreover, are quite experienced at the work. The diameter of a well sunk at any selected spot is usually about 4 ft.; if after sinking to a depth of about 20 ft. no chalk is found, the well is filled in and another one dug somewhere else. Considering the irregular level of the chalk the drawers are very successful in lighting

* See the writer's "Fertility of the Soil," Cambridge Manuals.

on suitable spots, and in general they strike chalk at less than 15 ft. At the top of the well a windlass is erected; this is a strong wooden structure standing on a base 6 ft. wide and 5 ft. from back to front; the moving wheel is 3 ft. in diameter and is furnished with a heavy block at the handle so that it always falls to the same position when at rest. The whole structure takes to pieces readily to facilitate transportation. The spring hook to hold the bucket is the most costly single part of it, costing about 30*s.*; the rest is not expensive. Two buckets are used, one to go down while the other travels up.

The well is continued right into the chalk, but after a time it is carried no deeper, and excavation is begun all round till a bell-shaped chamber is made. The determination of a suitable depth requires some judgment, for if the work is begun too soon the sides may fall in and bury the digger.

As the chalk is filled into the bucket it is hauled up, put into the wheel-barrow, wheeled off, and tipped out into little heaps so placed so as to give the required dressing per acre. Each heap is kept separate for convenience of spreading, and also for ascertaining the amount drawn.

In course of time these heaps are scattered over a somewhat circular patch of land of which the well is approximately the centre. It is obvious that, after the patch reaches a certain size, much time will be lost in wheeling the barrow backwards and forwards, and in practice 3 or 4 acres is as much as one well can conveniently serve. Another site is then chosen, a well sunk, and the chalk drawn out and distributed in heaps as before; this is repeated till the field is finished or till bad weather sets in and stops work; the heaps are then spread.

As already stated, the operation is carried out as piece-work. The cost of sinking the well is a matter for arrangement, but it does not usually exceed 6*d.* per ft. depth, so that if the digging has to proceed for 24 ft. the cost is 12*s.* Though the first attempts may be failures the full price is nevertheless charged. The usual price for hauling, barrowing and spreading is 7*d.* per load. Each bucket holds a bushel, each barrow holds two buckets-full, and ten heaps, *i.e.*, 10 barrow loads or 20 bush. equal a load. The amount payable can, therefore, be reckoned out very easily, for none of the heaps is spread till the whole field is covered. If the chalk is near the surface, so that the well is not deep, more chalk can be drawn out than is needed for the surrounding area and clamped close by at 6½*d.* per load to be carted at a more convenient season. A single well can be made to yield as much as 500 loads of chalk. A certain number

of large flints are found also ; these are clamped at 1*s.* per load. They are too large for roadmaking but they do well for garden walls, etc.

When as much chalk is removed as is required the clay through which the well was sunk is thrown back at a cost of 1½*d.* per load, and a rather ugly hole is left which is usually trimmed down to make a dell in order that it shall not be dangerous. A good deal of raw subsoil is thus exposed, and for some years the dell is rather an eyesore, abounding in thistles. In time, however, the cultivating implements can get through and a normal crop be taken, and the process can be hastened by casting spare heaps of soil into the dells. It is many years before the dells fill up, and they are a characteristic feature of the whole of the Clay-with-Flints formation. The beneficial effect of the dells as regards drainage is referred to later.

In the old days the dressings were 80 to 100 loads per acre, according to the situation of the chalk. Nowadays the dressings are smaller, about 50 or 60 loads, and the cost proportionately less. In two cases where close accounts were kept the figures were :—

—	Amount applied per acre.	Cost per acre.
Rothamsted Farm—	Loads.	£ s. d.
Chalk dug	50	3 7 10
Chalk carted from sewage works	20	3 6 8
Neighbouring Farm—		
Chalk dug	60	2 1 5

The Rothamsted figures show that the cost per load of chalk dug is considerably less than that of carted chalk. The detailed figures for the neighbouring farm are as follows :

	£	s.	d.
1st Hole.			
Digging 24 ft. at 6*d.*		12	0
Hauling out and spreading 146 loads of chalk at 7*d.*	4	5	2
Hauling out and clamping 140 loads of chalk at 6½*d.*	3	15	10
4 loads of stones at 1*s.*		4	0
Re-filling hole, 236 loads at 1½*d.*	1	9	6
2nd Hole.			
Digging 17 ft. at 6*d.*		8	6
Hauling out and spreading 330 loads of chalk at 7*d.*	9	12	6
Hauling out and clamping 170 loads of chalk at 6½*d.*	4	12	1
10 loads of stones at 1*s.*		10	0
Re-filling hole, 216 loads at 1½*d.*	1	7	0
Total for 786 loads chalk	£26	16	7

This dressing sufficed for 13 acres.

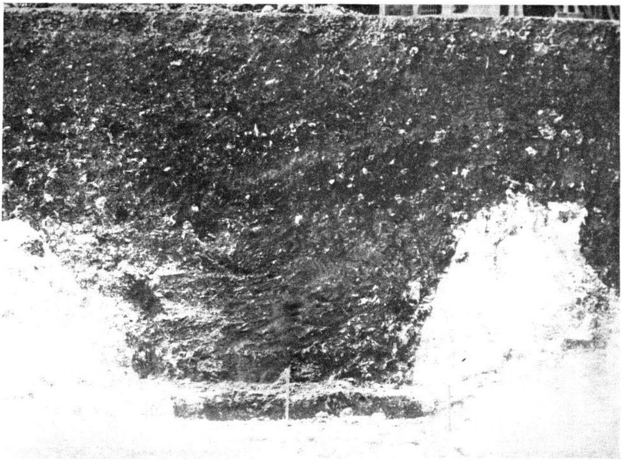

FIG. 1.—Photograph of a cutting, 12 ft. deep in the Clay-with-Flints at Harpenden, showing chalk near the surface at A and B but much lower down at C.

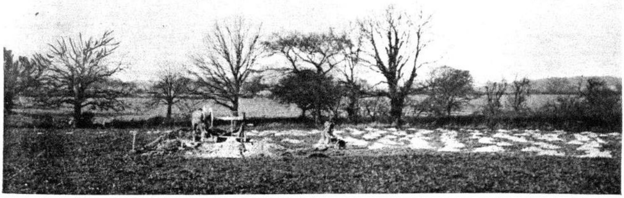

FIG. 2.—Drawing and spreading chalk. Hertfordshire method.
(*Photo by* Dr. Hutchinson.)

The work is done in autumn and winter. The chalk is soft and easily crumbles, a single night's frost sufficing to shatter the lumps. It can, therefore, be ploughed in very soon after spreading; the large lumps work up to the surface but soon break down. No time is lost, and the spring crop is got in in the usual way.

How long does the Chalk Dressing last?—Chalk is not very soluble, and the heavy dressings last a long time. The loss may be roughly estimated at about a load and a half per acre each year. Some of the fields heavily dressed many years ago still contain enough to last a long time yet, and the life of the dressings applied more recently is usually reckoned at 25 to 40 years. Although the work was regarded as the tenant's business the landlord was often induced to pay part of the cost, sometimes as much as half. When the tenant had borne the whole cost he was compensated if he quitted the holding within 15 years.

The Advantages of Chalking.—There are four chief advantages following the application of chalk:—

1. The soil becomes more porous and draining is facilitated.
2. The soil is easier to plough and to work down to a fine tilth.
3. A better clover plant can be obtained.
4. Swedes and turnips become less liable to finger-and-toe.

Other advantages are also claimed for it, *e.g.*, farmers commonly declare that Mayweed is suppressed by chalking. These advantages operate throughout the whole rotation; and few single operations effect so wide an improvement.

Instances of the improved condition of the soil are furnished in the Rothamsted fields. The heavy rains of December, 1914, and January, 1915, lay longer on the unchalked than on the chalked land. On walking over the fields with a stick when they were soaking with wet the chalked portions could be distinguished by the ease with which the soil flaked off, as compared with the stodgy condition where there was no chalk. Under drier weather conditions the difference is more striking, the chalked part having a well-drained appearance, while the unchalked part is still glazed and sticky. The ploughman finds it considerably easier to plough the chalked than the unchalked land.

Another instance is described by J. A. Hanley in this *Journal* for August, 1912 (vol. XIX, p. 375); in this case the farm had not been chalked and the land had got into a sticky, intractable condition in consequence.

Effect of Chalking on Different Crops.

Clover.—The difference of yield in clover was well illustrated last year at Rothamsted. "Pastures field" always lies wet in winter, and in December, 1914, and January, 1915, it was particularly bad. The winter oats of 1913-14 had been seeded with clover in the usual way, but the excessive wetness tried the clover very seriously. It suffered permanently on the unchalked land; when early summer came the plant was so thin that grass and weeds appeared in quantity. On the chalked land, however, it recovered very quickly, and when cut in June, 1915, it was far ahead both in quantity and, in the wet places, in purity. The final results were:—

—		Weight of Clover Hay, cwt. per acre.	Botanical composition, per cent.		
			Grasses.	Clover.	Other Plants.
Wet end (west)	Chalked...	30·1	19	78	3
	Unchalked	18·6	42	49	9
Dry end (east)	Chalked...	35·8	29	68	3
	Unchalked	20·2	26	71	3
Mean of both	Chalked...	37·5	—	—	—
	Unchalked	19·4	—	—	—

Barley.—The improvement in soil tilth reacts favourably on the barley crop. This was shown on the Great Knott Wood Field which carried barley in 1913. The chalked plots gave 68 bush. of grain against 59·4 on the unchalked. There was practically no difference in the bushel weight, which was 54·6 lb. for the chalked and 54·5 lb. for the unchalked. Nor was there much difference in the yield of straw, the chalked plot carrying 26·6 cwt. against 24·1 on the unchalked. The season was a good one, and all the barley plots did well, the plot in Hoos Field, which has grown barley continuously since 1852 without any manure, yielding no less than 21 bush., against an average for the whole period of 12·7 only. In 1914 the same plot also carried barley, but the season was not nearly so good owing to the long spell of dry weather in April and May, and the yield was much less. The chalked plot gave no better return than the rest. The barley all ripened badly and the harvest was prolonged. There is nothing to indicate that the chalking does more than help the plant in the early stages of growth. The yields were as follows:—

Barley (Plumage-Archer Cross). Great Knott Wood Field, 1913 and 1914.

—	Dressed Grain. Yield.		Weight per bush.		Straw.		Total Produce.	
	1913.	1914.	1913.	1914.	1913.	1914.	1913.	1914.
	bush.	bush.	lb.	lb.	cwt.	cwt.	lb.	lb.
Unchalked ...	59·4	30·3	54·5	53·8	24·1	17·6	5,994	3,990
Chalked ...	68·2	28·8	54·6	53·5	26·6	19·2	6,700	4,035

Both plots were manured with ¾ cwt. of sulphate of ammonia and 2½ cwt. of superphosphate per acre in 1913, and with 1 cwt. of sulphate of ammonia and 2 cwt. of superphosphate in 1914.

Winter Oats gave no return at all for chalking. A negative result does not prove very much, but this is in agreement with the general experience that oats are not so sensitive to adverse soil conditions as barley: for example, Wheeler found at Rhode Island that oats were less affected by soil acidity than most other crops. The following yields, which it will be observed were on the low side, were obtained :—

Oats (Grey Winter). Sawpit Field, 1914.

—	Dressed Grain. Yield per acre.	Weight per bush.	Straw per acre.	Total Produce per acre.
After Fallow and Dredge Corn—	bush.	lb.	cwt.	lb.
20 loads Carted Chalk (1)	37·3	43·9	32·3	5,351
50 loads Dug Chalk (2)	41·1	44·1	38·4	6,159
Unchalked	44·6	44·1	35·7	6,006

(1) From excavations for Harpenden Sewage Beds.
(2) From Rothamsted Fields.

Potatoes also failed to respond to chalking. As in the case of oats, this crop is less affected than clover or barley by soil acidity, and, moreover, it is planted so late in the year that the bad effects of winter rainfall have already disappeared to a large extent. It is commonly asserted in some of the potato-growing districts that liming encourages scab, but there was nothing in the experiment to indicate that chalk did so. The crop yields were as follows :—

Potatoes (Dalhousie). Great Harpenden Field, 1914.

Dressings.	Tons per acre.				Mean.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	
Unchalked	8·9	8·7	9·8	9·6	9·3
Chalked (about 20 loads per acre)	9·0	8·5	—	—	8·8

The effect of chalking on the yields of the above four crops is shown graphically in Fig. 3.

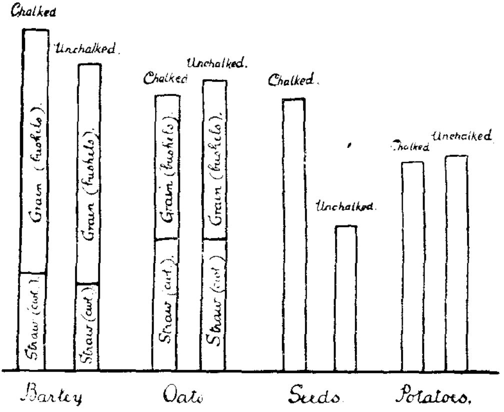

Fig. 3.—Effect of Chalking on the yield of various crops.

Chalk v. Ground Lime.—Hutchinson and MacLennan* have recently pointed out that lime and chalk differ fundamentally in their initial biological action in the soil. Later on, however, the lime becomes converted into chalk, so that for practical purposes a comparison may fairly well be instituted between them. If lime is applied, the cheapness of initial cost is in its favour. This advantage, however, is soon lost, for whilst chalking lasts a lifetime the liming has to be done once in every rotation; there is, further, a distinct tendency to neglect it in bad seasons when it would be most helpful. Moreover, the dells left after chalking sometimes facilitate draining. The surface of the land being rather undulating there is not always a satisfactory outflow for the surface water. Where the water can be led into a dell, however, it soaks away more readily.

* *Journ. Agric. Sci.*, March, 1915.

SMUT DISEASES OF WHEAT.

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OF all the diseases to which cultivated crops are subject, few are more conspicuous than the smuts of the various cereals. Wheat, barley and oats are all liable to become smutted; indeed, each of these crops is subject to two kinds of smut.

Unfortunately the name "smut"—as in the case of other common names of plant diseases—is often used indiscriminately. The term is appropriate enough for any one of the diseases, but, since it fails to discriminate between distinct maladies, its use leads to a great deal of confusion. This is especially apparent in dealing with smut in barley. The two smuts of barley are somewhat similar in appearance, but the methods of control which are efficacious for the one are utterly useless for the other. Again, in the case of wheat, the same term is commonly applied to a disease which destroys only the grain and to another which destroys practically the whole ear. In the case of oats the looseness of the name is of less account, for the two smuts of this crop present but few and unimportant differences.

Each of the smut diseases is caused by a different fungus, though these fungi present certain family resemblances.

The family to which they belong includes a considerable number of species, though none are of the same economic importance as the members which attack corn crops. In most species the parasite can only gain entrance to the host plant at particular and well-defined periods in the life of the latter. Furthermore, for a greater or less period, the fungus inflicts no visible damage. Only when it commences to form spores are the host tissues seriously affected.

The classification of the cereal smut fungi has only become possible within recent years. Until the 'eighties of last century the smuts of barley and oats, together with one of the smuts of wheat, were regarded as one species. Even when the identity of the several species was established, it was thought that, though differing in form, all had the same life history. This error proved of serious practical significance, since the methods of control which proved satisfactory in one case failed entirely in another.

Bunt, Stinking Smut, or Slayne.—An attacked plant presents no unusual features until harvest time approaches, when it may be detected by an unusual uprightness and whiteness of ear, and

by the fact that the chaffy scales of the ear spread out rather more than those of a healthy plant. (Fig. I., 1 and 2). On examination the grains are found to be plump and rounded and to consist only of a thin skin surrounding a mass of black powder with a more or less pronounced fishy smell (Fig. I., 3). The black powder consists of the spores of the fungus *Tilletia tritici* (Bjerk.) Winter.*

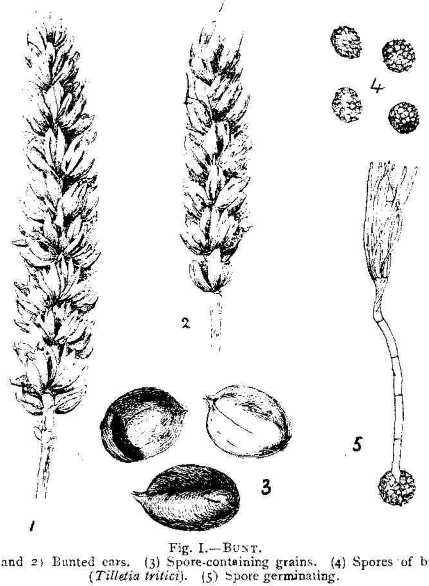

Fig. I.—BUNT.
(1 and 2) Bunted ears. (3) Spore-containing grains. (4) Spores of bunt (*Tilletia tritici*). (5) Spore germinating.

When the crop is threshed, most of these spore-containing grains burst, the spores are liberated in clouds, and the healthy grains become coated with them. A number of spore-grains, however, generally pass through the machine and may be found cracked or broken in the threshed corn. If not otherwise patent,

* A second species, *Tilletia fotens* (B. and C.) Trel., is recorded for this country, but appears to be rare. I have not met with it in the North of England. It differs from *T. tritici* in possessing smooth spores. Its life history is said to be identical with the ordinary bunt fungus.

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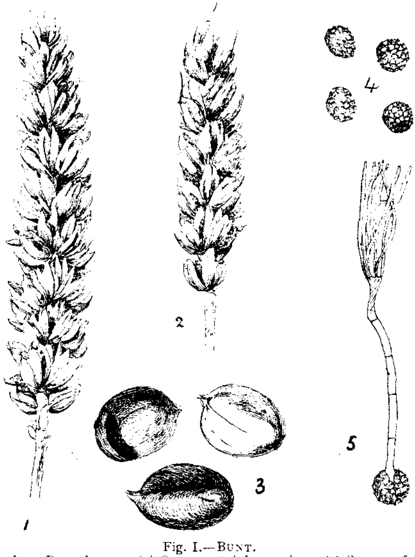

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it is often possible to recognise a bunted sample by rubbing between the hands and then smelling the corn, when the fishy odour characteristic of the disease may be detected.*

The spores, technically known as chlamydospores, are spherical or subspherical in shape, single celled, with a thick, dark-coloured wall, marked on the surface with prominent reticulations (Fig. I., 4).

They germinate readily, though slowly, in a drop of water. In the course of a week or ten days the wall cracks and a delicate tube is protruded, which eventually bears a ring of elongated, single-celled, secondary spores or conidia (Fig. I., 5).

Germination thus results, in the first place, in multiplication of spores. The process is carried still further in a watery extract of fertile soil, the conidia themselves giving rise to a second crop of spores; and probably this takes place in nature in most soils. Both the first formed and the secondary conidia are capable of germination at once, producing a colourless tube which may infect the young wheat plant.

Infection takes place only when the plant is in the seedling stage, and chiefly before the shoot is ½ in. long. A plant which has produced green leaves is immune from attack. Spores present on the grain when it is sown are thus very favourably situated for securing infection.

The germ tube which proceeds from the conidium bores its way into the young shoot, and the resulting hyphæ at once make their way to the growing point of the stem. Without branching greatly, the fungus grows with the plant, always maintaining itself at the apex of the stem, and, when the ear is formed, pushes its way into the young grain. As food is passed into the ear for the growth of the grain, the parasite seizes upon it, and now commences to grow rapidly, completely destroying the tissues inside the grain. Eventually the hyphæ become divided into short cells which thicken their walls, round themselves off, and separate, forming the black chlamydosphores.

Spread of the Disease.—One of the most potent factors in the spread of this disease is undoubtedly the thresher. A machine which has been used for a bunted crop becomes itself infected with spores and serves to infect grain which subsequently passes through. Sacks in which bunted grain is stored also become impregnated with spores, some of which find their way on to any healthy seed subsequently put in them. Free spores may live for two or three years, while spores in unbroken grains have

* A test often practised on some of the Continental Bourses.

been known to retain their vitality for seven or eight years.* Thus, grain from a perfectly healthy crop may easily become impregnated with bunt spores before it is ready for sowing, though in such case it will hardly show any signs of contamination to the naked eye. Some writers have gone so far as to suggest that wheat seed perfectly free from bunt spores is not obtainable on the market. Observations recently made in the laboratory at Armstrong College almost bear out this generalisation. Of 33 samples collected in the Newcastle district, 32 were more or less badly infected. All of these samples appeared perfectly clean, but, with one exception, bunt spores could readily be detected by washing a few grains in water and then examining a drop of the water under the microscope. This experience, if it does not prove the universality of infection, certainly shows that outwardly sound wheat is very frequently impregnated with disease spores, and it indicates that it is a wise practice to assume that grain is infected, and to take due precautions before sowing it.

It is, of course, true that infected seed does not always produce a bunted crop—otherwise there would be few healthy crops grown—but this contention might be urged in the case of all fungoid diseases. The presence of the fungus is an indispensable, but not by any means the only condition requisite for disease production. In the case of bunt, indeed, there is evidence that other factors play a very important part.

Several writers on the subject have noted that seed artificially inoculated with viable spores sometimes fails to produce the disease. The date of sowing has evidently a considerable effect on the incidence of bunt. In the North of England it is the common experience that spring-sown wheat suffers more than autumn-sown.† Experiments conducted by Munerati‡ also demonstrated that the proportion of bunted plants in a crop varies greatly with different dates of sowing.

These facts notwithstanding, the only possible method of ensuring freedom from the disease lies in regular treatment of seed corn, whether it appears bunted or not.

Treatment.—The disease spores may easily be killed by treating seed corn, before sowing, with a poisonous liquid. A considerable number of substances have been tried at different

* Güssow, H. T. *Canadian Dept. of Agric.*, Bull. 73, 1913, p. 17.

† Mr. Frank P. Walker, Adviser in Agriculture in Armstrong College, has kindly supplied me with this information. For the collection of numerous samples, and for other assistance in connection with investigations on cereal smuts, I have pleasure also in acknowledging my indebtedness to him.

‡ *Jour. d'Agric.* 76, II. Paris, 1912.

times for this purpose, *e.g.*, potassium sulphide, salt, sodium sulphate, caustic soda, carbolic acid, sulphuric acid, hot water, and urine. Recently, hydrogen peroxide has been used with, it is stated, satisfactory results.* On the whole, however, copper sulphate and formalin have proved the most reliable, and one or other of these substances is now used regularly on many farms.

Copper sulphate is sold either as crystals or in the powdered form. The latter is preferable, as it dissolves more easily. It should be of 98 per cent. purity. The most convenient method of application is to spread out the grain on a barn floor, and water it with a solution made by dissolving 1 lb. of copper sulphate in 1 gal. of water. After shovelling over the heap till all the grains are thoroughly moistened, it may be spread out and allowed to dry. One gallon of solution is sufficient to treat 4 bushels of seed. This operation is commonly spoken of as "pickling."

Copper sulphate retards the germination of the grain, and a solution of the above strength will generally be found to lower somewhat the total germination capacity. Probably a solution of half the strength would be equally effective, but in the absence of experimental evidence on the point it is safer to use the stronger solution.

Formalin consists of a 40 per cent. solution of the gas formaldehyde. It has to be used in minute quantities, and for this reason there is sometimes a little difficulty in accurately measuring the right quantity. The writer has, therefore, latterly adopted the practice of measuring formalin in tablespoonfuls, an ordinary medicine bottle being used as a measuring glass. Three tablespoonfuls of formalin in 1 gallon of water gives a solution of suitable strength for "pickling" seed wheat. The liquid is applied in the same manner as copper sulphate. Used in the above strength, formalin will not injure the germination capacity of the grain, but care has to be taken that the solution does not exceed 3 tablespoonfuls to the gallon.

Several proprietary substances, whose advertised virtues include the suppression of bunt, are upon the market. In the absence of experimental evidence it is impossible to generalise upon their real values, but cases are not wanting where the use of some, at least, of these unproved remedies has been attended with disastrous results.

The worst that can be urged against copper sulphate and formalin is that neither affords efficient protection against birds. Where damage of this kind is anticipated the seed should be

* *Kew Bulletin*, No. 5, 1913.

dressed twice—first with copper sulphate or formalin, and then with whatever preparation is effective against birds. No single substance yet tried appears to afford the double protection. If spore-containing grains are present in the corn, it is advisable to remove as many of them as possible by means of the winnower before "pickling."

Loose Smut.—This disease makes its appearance when the crop "shoots," *i.e.*, when the ear is pushed up out of its enclosing leafy sheath. Instead of the normal ear, a sooty mass, consisting in reality of a central axis and a few chaffy fragments, surrounded

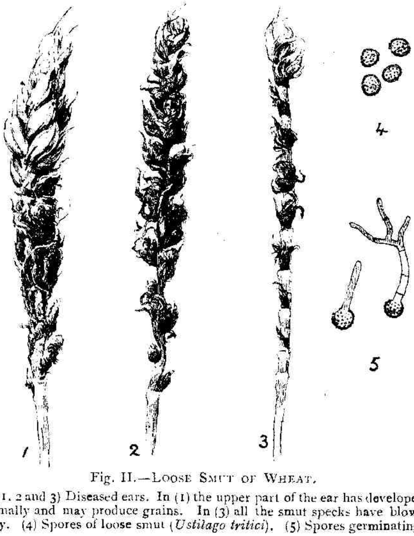

Fig. II.—LOOSE SMUT OF WHEAT.

(1, 2 and 3) Diseased ears. In (1) the upper part of the ear has developed normally and may produce grains. In (3) all the smut specks have blown away. (4) Spores of loose smut (*Ustilago tritici*). (5) Spores germinating.

by a quantity of black powder, is produced (Fig. II., 2). Though very conspicuous when it first "shoots," a diseased plant soon becomes less noticeable, for the smutty powder is quickly blown or washed away, leaving only a bare stalk (Fig. II., 3).

The cause of the disease is a fungus named *Ustilago tritici* (Pers.) Rostr. The "smut" itself is composed of countless numbers of the minute chlamydospores of the parasite.

The spores are small, spherical to egg-shaped, with a thick wall covered with minute spores (Fig. II., 4). They germinate in water within a few hours, producing a tube, which branches but does not bear conidia (Fig. II., 5).

These spores are incapable of infecting the young plant. If, however, spores are introduced into the wheat flower while the grain is still small and green, infection is brought about. The spores germinate inside the flower and the germ tube which is produced penetrates the immature grain giving rise to a small amount of mycelium in the embryo and starchy endosperm of the latter. Development of the grain, however, continues, despite the fungus within. Diseased grains are generally somewhat small and shrivelled; often, however, they are large and plump. In either case infected grains are, by external examination, indistinguishable from healthy.

When infected grains are sown the fungus grows with the young plant, much in the same way as the bunt fungus. As soon as the ear commences to form in the sheath, the mycelium increases its rate of growth, branches profusely and divides up to form a great mass of spores. These are at first held together by a gelatinous substance on their walls, and the whole mass is enclosed in a thin skin. This skin is often ruptured as the ear is being pushed up out of the sheath; in other cases it escapes intact, and is ruptured only by wind or rain. It frequently happens that an attacked ear is smutted only at the base, normal grain developing from the upper parts (Fig. II., 1).

The spores retain their power of germination for a few months only. Thus, unless they obtain entrance to wheat-flowers at the time they are produced they become harmless. It is not known how long the grain remains open to infection, though, as it develops very rapidly in its early stages, that time is probably limited to a few days.

The peculiar life history of this fungus, discovered only in 1904, is fully confirmed by experiments which have been conducted here during the last two years. Particulars of these experiments will be published elsewhere.

Flowers of healthy plants were artificially inoculated with smut spores, by means of a small camel-hair brush. The grains developed from these flowers were collected when ripe. A few were reserved for microscopical examination and the remainder were sown the same autumn. In sections of the infected grains the fungus mycelium could be clearly distinguished both in embryo and endosperm. Of the plants raised from infected grain in the following year, 25 per cent. had smutted ears.

On the other hand, untreated grains, as well as healthy grains coated with smut spores before sowing, and germinated grains dusted with spores before planting out, all developed healthy plants. Hence it is clear that the fungus is capable of entering the *young* grain, but is incapable of penetrating the seedling.

It is noteworthy that the amount of disease (25 per cent.) was not very high. In other experiments, where infection took place under highly favourable but natural conditions, less than 3 per cent. of smutted plants resulted. In keeping with these results is the relative freedom of English wheat fields from the disease. In Continental countries, especially Germany, it appears to be much more abundant.*

Control.—Owing to the economic importance of the disease on the Continent, a good deal of experimental work on methods of control has been carried out within recent years.

Since the fungus is present inside the grain it is obviously impossible to prevent the recurrence of the disease by dressing the seed with poisonous fluids.

Attempts have been made to control the disease by picking out smutted heads from the standing crop as soon as they appear, with a view to preventing infection of the young grain. The results have been fairly satisfactory, but the method could not be applied on a large scale.

It was at one time thought that diseased grains were always small and shrivelled; hence it was contended that thorough winnowing before sowing was a sufficient precaution. Recent experiments, in which the seed from crops which had been badly smutted was sorted into sizes, have entirely failed to confirm this opinion.

It has been remarked that the spores on a smutted head quickly blow away, and that if they fail to find their way into a flower at once they soon die. Now the proportion of grains which becomes infected on the plants actually in contact with smutted ears, is very small—less than 3 per cent. in the experiment cited above. Hence the chances of plants in neighbouring fields becoming infected are so small as to be negligible, and we may reckon with confidence on seed from a healthy crop being free from infection. If due care is taken in the choice of seed no trouble from loose smut will be experienced. Seed from fields which have had many smutted heads should be avoided. When home-grown seed is used this is an easy matter, but it is difficult to ensure disease-free seed where a new variety is intro-

* *Vide* Appel and Riehm, *Arb. a. d. Kais. Biol. Anst., VIII.*, 1913, p. 343.

duced. Unless the crop from which seed is bought has been seen personally, reliance has to be placed on the observation and veracity of the grower.

Treatment of Infected Grain.—Though the actual life history of the fungus causing the disease has only recently been discovered, it has for long been known that methods of prevention which were suitable for bunt and other cereal smuts failed in the case of loose smut. As early as 1887 Jensen discovered that the disease could be prevented by heating the grain before sowing. In this case, therefore, a method of prevention was found before the life history of the fungus causing the disease was known. The method which Jensen evolved has, with certain minor modifications, been adopted by various subsequent workers on the subject, and it has been repeatedly demonstrated that by soaking infected grain for 4 hours in cold water—or, better still, in water at 25°–30° C. (77°–86° F.)—and then heating for 10 minutes to a temperature of 52°–54° C. (125°–129° F.) in hot water or hot air, the fungus inside the grain is destroyed, and the grain itself suffers no injury.

Hot-water treatment without previous soaking is not nearly so effective. The necessity for previous soaking apparently lies in the fact that the fungus mycelium in a dry grain is in a dormant state, but that a few hours soaking is sufficient to "awaken" it and bring it into a condition in which it is more susceptible to outside influences. In its dry state the mycelium is comparable to a resting spore or a seed, and, after soaking, to a germinated spore or a seedling plant. Jensen's method has been applied with variations of detail in numerous trials on a large scale, and treatment of infected seed may now be regarded as a practicable, if somewhat cumbersome, operation.

The following are the chief methods tried up to the present:—

1. HOT WATER.—(*a*) *Dipping.*—The grain to be treated is put into sacks and allowed to stand in cold water for 4 hours. The sacks are then lifted out and placed for ten minutes in a tank of water kept at 52°–54° C. (125°–129° F.), being repeatedly heaved up and down in the water to remove bubbles of air from around the grains. The grain is then removed and spread out to dry. This operation can be performed on almost any farm where there is a boiler. It has been carried out so extensively in the co-operative dairies in Denmark that the disease is now said to be practically exterminated. It appears to be practised largely in Holland also, and it is, undoubtedly, the method most suitable for use in this country.

A loss of 10–20 per cent. in the germination capacity of the grain must be allowed for under farm conditions.

(*b*) *Forcing Hot Water through the Grain.*—The seed, after soaking, is placed in a specially-constructed vessel, and hot water of the required temperature is driven through from below. The rather elaborate apparatus required is a drawback to this method.

(c) *Forcing Steam through the Grain.*—The seed is soaked and then immersed in a large vessel of water through which steam is forced. This appears to be a dangerous method, for the steam must kill grains with which it comes in direct contact. It is said, however, to have achieved fairly good results.

2. HOT AIR.—One great objection to all hot-water methods is the difficulty of drying the seed afterwards. For this reason attention has been turned to the possibility of heating the grain by hot air.

(a) *Kilns.*—Several attempts have been made to utilise kilns of breweries, but the same difficulty is met with here as in laboratory trials with ordinary ovens, namely, that it is impossible to heat the grain evenly.

(b) *Drums.*—Various kinds of drums have been constructed for obviating this difficulty. The drums are heated to the required temperature and the wet grain is then allowed to roll slowly through them. The machines appear to have met with a limited use, but, as far as present experience goes, they seem to have justified their existence.

Treatment of Diseased Grain in this Country.—So far as the writer is aware, no attempts have been made to treat diseased grain on a large scale in this country. The first method—dipping in hot water—is the only one likely to prove useful here, and in discussing its applicability to British farming, the following points have to be borne in mind.

The whole of the seed has to be treated, and the risk of injury has to be run, for the sake of a small proportion of diseased grains. In this respect the loose smut is different from bunt or from oat smut; in these cases all the grains of a smutted sample are infected, and all equally liable to produce smutted plants.

On an average farm the operation would be carried out only once or twice a year, and then with a large quantity of grain. This would make it a good deal more troublesome and expensive than where apparatus for co-operative use was installed.

At any time it is a difficult and delicate operation. The water must be maintained at the exact temperature required, an accurate thermometer being, of course, necessary. It must be remembered, too, that a large bulk of grain is difficult to dry.

Finally, there is the question as to whether it is worth while. There are, unfortunately, no statistics concerning the amount of the disease in different parts of the country, and reliance has therefore to be placed on casual observations. Smutted plants may be found in nearly every wheat-field in the north-eastern counties, but, as far as the writer has seen, there is seldom a sufficient amount to make hot-water treatment a paying proposition in ordinary farming.

It has sometimes been suggested that farmers should treat a small amount of seed one year with a view to raising healthy stock for next year's sowing: the writer has this year been in

correspondence with a farmer who is adopting this practice. Whether the advantage gained by preventing loose smut will counterbalance the disadvantage of using the same seed for several years in succession is a practical point which experience alone can determine.

It may be pointed out that a sound stock of seed ought, for all practical purposes, to remain sound for several years. For this reason the hot-water treatment should commend itself to seedsmen and farmers growing wheat for seed, especially where a new variety is being propagated.

In ordinary farm practice, care in the choice of seed corn is the only preventive scheme which can be recommended, and it should be recognised that grain from a crop known to have been badly smutted ought not to be offered for sale as seed corn.

THE UTILISATION OF WASTE LAND.

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OWING to the increased cost of labour the uplands in many parts of the country have, in recent years, been more or less neglected. Some fields which were at one time under the plough are now carrying poor grass, or have entirely run to waste. Such land is to be found in Devon on the table land in the north-east of the county. Most of the land referred to is on what is known by geologists as the Upper Greensand; it is not entirely of a uniform character, and in places there is a considerable mixture of "Clay-with-Flints," which tends to improve its character. The land is generally about 800 or 900 ft. above the sea level, and one reason for its present neglect is the difficulty of haulage; what crops it might produce are consumed on the holdings in the valleys, and the farmyard manure is not carried up, so that the land has in many cases become unprofitable because it has been robbed of its fertility.

The land on which the following experiments were carried out is in the occupation of the Vicar of Broadhembury, Rev. C. Lister James, M.A., to whom the success of the experiments is largely due. The land is situated above the village of Broadhembury, not far from the ancient earthworks known as Hembury Fort. The soil was roughly ploughed in 1914 and left fallow for that year. In the spring of 1915 one acre was put into mangolds and another acre into potatoes.

With regard to the composition of the soil, there is a deficiency of phosphate, a deficiency of lime, and but little available nitrogen, although the total nitrogen, as indicated by

analysis, is large—probably more than 3½ tons to the acre in the first 9 in.

It is interesting to notice that there is ample potash, since both the mangold and potato crops require large amounts of potash, and good crops were obtained without the use of any potash manures.

As the supplies of potash manures are now cut off owing to the War, it is important to observe that good crops, in yield much above the average obtained on the surrounding and more highly-rented cultivated land, can be obtained by the application of phosphates and nitrogen; the crops produced were large enough to leave a good profit.

The mechanical analysis of the soil given in the table below shows but little clay, but very much fine silt and sand. The soil is also markedly acid owing to the total absence of carbonate of lime. Some crops, such as swedes, would not, therefore, grow satisfactorily unless the land was limed.

Analysis of the Soil, Broadhembury Hill, Honiton.—On the border of the Upper Greensand, 900 ft. above sea level, waste land ploughed in the spring, 1914; sample taken in spring, 1915:—

Mechanical Analysis.	*Per cent.*
Fine gravel	7·3
Coarse sand	22·1
Fine sand	16·5
Silt	13·0
Fine silt	20·51
Clay	2·88
Chemical Analysis of the Fine Soil.	
Total nitrogen	0·35
Phosphoric acid soluble in strong acid	0·27
Phosphoric acid soluble in 1 per cent. citric acid	0·0079
Potash soluble in strong acid	0·28
Potash soluble in 1 per cent. citric acid	0·014
Acidity (amount of carbonate of lime neutralised)	0·33

The crops were grown on plots each 1/20th acre in area; the crop of potatoes where dressings of nitrogen and phosphates were given was composed of good marketable tubers; the crops on the unmanured plot and on the "no phosphate" plot consisted mainly of small unmarketable tubers.

Regarding the mangold crop, the roots grown where slag, salt and nitrate of soda were used, weighed nearly 29 tons per acre; the crops produced both on the unmanured plot and also where phosphate was omitted were so small that they were useless.

The unmanured plot of mangolds produced only about 8 cwt. of roots per acre, and the plot receiving nitrate and kainit but "no phosphate" was no better than the unmanured plot.

By the application of 5 cwt. of basic slag, 4 cwt of kainit and 3 cwt. of nitrate of soda over 30 tons of roots were produced. By the use of 5 cwt. of basic slag, 3 cwt. of nitrate of soda and 4 cwt. of common salt 29 tons of roots per acre were grown, and this was the most profitable plot.

On the area under potato cultivation the unmanured plot produced less than 2 tons of small tubers per acre. On the plot receiving 3½ cwt. of superphosphate (33 per cent. soluble phosphate) and 2¼ cwt. of sulphate of ammonia, the crop was 9 tons 16¾ cwt. per acre. By the additional use of 1¾ cwt. of sulphate of potash the crop was further increased by 11 cwt. of tubers per acre.

Without phosphate the crop produced by the use of 2¼ cwt. of sulphate of ammonia and 1¾ cwt. of sulphate of potash was only 1 ton above that of the unmanured plot.

In 1915, therefore, substantial crops of mangolds and potatoes were grown on this derelict land (rented at 2*s*. 6*d*. per acre) by the use of artificial manures only.

In the spring of 1916 oats were sown on the land which in the previous year had produced mangolds and potatoes; 6 cwt. of basic slag per acre were applied before the seed was sown, and at the time of sowing 1 cwt. of sulphate of ammonia per acre was distributed. The resulting crop was 55¼ bushels of grain and 1 ton 10½ cwt. of straw per acre. The straw was 5 to 6 ft. in height and the grain was an especially good sample. A mixture of grasses and clovers was sown with the oats and at the present time the clover looks most promising. For the oat crop the whole of the area was treated alike and there was no unmanured plot. The outlay in manures in the two years and the value of the resulting increased crops may be given as follows:—

Potato Crop, 1915.

Per acre.		Per acre.
3½ cwt. superphosphate .. 2¼ ,, sulphate of ammonia	Costing 42*s*.	Value of increased crop of potatoes at £4 per ton = £31.

Mangold Crop, 1915.

5 cwt. basic slag .. .. 4 ,, salt .. .. .. 3 ,, nitrate of soda ..	Costing 76*s*. 6*d*.	Value of increased crop of mangolds at 10*s*. per ton = £14 6*s*.

Oat Crop, 1916.

6 cwt. basic slag .. .. 1 ,, sulphate of ammonia	Costing 43*s*.	Value of oat crop [grain 4*s*. per bush., straw £3 per ton] = £15 11*s*. 9*d*.

The mangold and oat crops, after deducting the cost of the manures, leave a gross profit of £23 18*s*. per acre for the two seasons.

It is clear that with fertilisers like basic slag and sulphate of ammonia, which are produced in this country and are available in large quantity, and which before the War were largely exported, profitable crops can be grown on land which farmers have regarded as not worth cultivation.

SUBURBAN POULTRY-KEEPING: A WAR-TIME EFFORT.

LUCY A. HUTCHINSON, B.A. (Hons.).

ALTHOUGH there are drawbacks to keeping poultry in the suburbs of towns there are also a number of advantages. The cost of the food may often be materially reduced by using the waste scraps from the house, and the waste vegetables grown in the garden, while there is no difficulty in disposing of the produce at good prices. The principal drawbacks are the annoyance caused to neighbours and the difficulty of arranging for the management of the poultry during the absence of the family on their annual holiday. These drawbacks are largely met in the system of poultry-keeping described in the present article. The system is that adopted by a resident living in the suburbs of a large and fashionable seaside town who, for the purpose of this article, is known as X.

At the outbreak of the war X decided to set aside a part of her back garden for the keeping of poultry. As she had very little time to devote to her fowls she decided from the first to work on rather novel lines. She decided to keep the birds for egg-production only, and do no rearing—hence no male bird was kept, and no annoyance caused to any of her neighbours. The ground was too small to admit of alternate runs, and yet it was necessary to give it a rest from time to time if used year after year, so X decided to sell her fowls before they moulted, thus setting herself free to close the house and have a holiday. During the interval the run was cropped with some gross feeding greens such as cabbage. The daily work consisted simply of feeding the birds three times, watering them twice, cleaning the dropping board each morning, and occasionally digging the run. X considers that for any active girl the work need only occupy thirty minutes a day, and may be safely undertaken, as in her own case, without previous experience.

When she came to arrange the details, X found that the space at her disposal was about 50 square yards of sandy soil. On looking out for a suitable poultry house, she was fortunate enough to come across a small wooden hut which had been built as a

motor cycle shed, and had been left on the maker's hands. This he sold to her for 36*s*. when adapted as a poultry house. The shed was 7 ft. long by 5 ft. wide, 5 ft. high at the eaves, and 7 ft. at the ridge. It was so placed that the original window of the shed was on the north side. The east end was occupied by a dropping board 3 ft. from the ground with 3 perches above. The upper part of the remaining half of the south front was replaced by wire netting with an adjustable shutter. The shed was only partly in the run, so that on wet days when the birds were not allowed out the work was done without entering the run. An orange box placed on one side under the dropping board was used as a nest box, and pot eggs, a wooden feeding trough, a zinc drinking fountain, and, later, a broody coop, completed the equipment. The sandy floor was covered with straw litter which was renewed from time to time as it became broken up. The run was surrounded by wire-netting 8 ft. in height. The total cost of house, fittings, run, etc., was £3 0*s*. 3½*d*.

The arrangements were complete towards the end of October, and on the 30th X received from friends, who were poultry farmers, 18 pullets at a price which was practically only the cost of rearing—3*s*. each. The birds were all cross-bred, from ordinary farmyard stock, and were of the heavy type, having been intended for table purposes, and only retained for laying owing to the war. A few had begun to lay, but four had obviously been hatched later than the rest, and did not commence to lay until February. One bird died during the first week, but a post-mortem examination showed that it suffered from heart weakness, and that death was not due to any cause which would affect the health of the rest. The remaining 17 fowls were quite healthy during the whole period.

The birds were fed three times a day as follows: —

Time.	*Quantity.*	*Food.*	*Method.*
8.0 a.m. ...	1½ lb. ...	Wheat or oats ...	Given on alternate days.
2.0 p.m. ...	(1) 6 oz. ...	Meat Meal ...	Scalded with boiled household scraps.
	5 ,, ...	Clover hay ...	
	1 lb. ...	Sharps	For drying off.
	3 teaspoonfuls	Poultry mustard	Mixed in sharps.
	(2) 6 oz. ...	Bran	Scalded as above.
	5 ,, ...	Clover hay ...	
	½ lb. ...	Pea or bean meal	For drying off.
	½ ,, ...	Sharps	
	3 teaspoonfuls	Mustard ...	Mixed in meals.
5.30 p.m. ... (earlier in winter).	¾ lb. ...	Wheat or oats ...	As in the morning.

The mash (1) was given on two consecutive days, and (2) on the third day. In cold weather, maize and oats were substituted for oats, *i.e.*, a half feed of maize was given every other day.

The mustard was discontinued in the warmer weather. A little sulphate of iron was used in the mash once a week, and permanganate of potash in the drinking water another day. The mash was fed in the trough; the grain was scattered in the litter in wet, and on the sandy soil (sometimes lightly buried in the soil) in fine weather. Greens—chiefly cabbages—were hung up in the house or run. As X's family is a very small one, consisting generally of only two persons, household scraps were few, and when, as was sometimes the case, they failed altogether, a handful of biscuit-meal was given instead, and was scalded with the meat meal and clover hay. X sold six of the fowls on June 11, as they showed a constantly recurring tendency to broodiness; the rest were retained until September 14. The total cost of food, £5 17*s*. 5½*d*., was thus for six birds for 224 days, and 11 birds for 318 days, thus averaging 8*s*. 7*d*. per bird per year. The food was, for the most part, bought in small quantities at the rate per stone or score.

Three features of the above diet are worthy of note, as contravening some of the generally accepted principles in feeding for egg-production.

(*a*) Beyond the alternation of the two grains, and the somewhat different mash every third day, there was no variation in the feeding.

(*b*) Although the diet was particularly rich in nitrogenous foods, the good health of the birds, their freedom from ovarian disorders, and the absence (with very few exceptions) of soft-shelled eggs, showed that it was not too stimulating. Contrary, too, to the usual advice, this high albuminoid ratio, and the same quantity of food, were continued throughout the summer, and with uniformly good results.

(*c*) A comparatively light meal was given towards the end of the day, whereas the general practice is to make every effort to send the birds to roost with their crops full.

The following table gives the number of eggs laid each month:—

Month.		*No. of Eggs*	*Month.*		*No. of Eggs.*
October 31.	1914	2	*Brought forward*		1,478
November	,,	184	May	1915	285
December	,,	240	June	,,	205*
January.	1915	224	July	,,	186
February	,,	255	August	,,	179
March	,,	315	Sept. (to 14th)		71
April	,,	258			
Carried forward		1,478			2,404

* 79 up to and including June 11, when 6 fowls were sold.

Thus, during the first period up to June 11, 1,842 eggs were laid by 17 birds, or an average of 108·3. In the second period, June 12—September 14, the remaining 11 birds laid 562 eggs, an average of 51·1. Taking the two periods together, the 11 birds retained the whole time laid an average of 159 eggs in 318 days—exactly an egg every other day, or at the rate of 182 per year.

The lowest number of eggs laid on any one day was 1 on November 3 and 6, and the highest 13 on five days in March. The eggs were sold chiefly at wholesale prices to a local dairy, a few only being sold at the retail rate. For her own household use X retained the smallest eggs at the wholesale price. The highest price was obtained from November 1-25, *viz.*, 5 per 1*s.* (wholesale), and the lowest from April 21-24, *viz.*, 11 per 1*s.* The amount realised by the sale of eggs was £16 6*s.* 5*d.*, being an average of 1*s.* 7½*d.* per dozen.

After the sale of the birds on September 14, X was able to draw up her trading account and balance sheet, as follows:—

Trading Account, 31st October, 1914—14th September, 1915.

	£ s. d.		£ s. d.
To 18 Pullets at 3s.	2 14 0	By Sale—6 Pullets, 1/6 ...	0 9 0
,, Carriage (birds and food)	0 10 0	,, ,, 11 ,, 1/10 ...	1 0 2
,, Straw litter	0 1 4	,, ,, Eggs	16 6 5
,, Food ... £6 5 5½			
Less Stock remaining 0 8 0			
	5 17 5½		
,, Balance c/d	8 12 9½		
	£17 15 7		£17 15 7
,, 10 per cent. Depreciation on Plant, £3 0 3½ ...	0 6 0½	,, Balance b/d	8 12 9½
,, Interest (for one year) at 5 per cent. on £3 0 3½	0 3 0		
,, Capital	8 3 9		
	£8 12 9½		£8 12 9½

Balance Sheet as on 14th September, 1915.

Liabilities.	£ s. d.	*Assets.*	£ s. d.
From Trading a/c	8 3 9	Plant £3 0 3½	
		Less 10 per cent. 0 6 0½	
			2 14 3
		Stock of food in hand ...	0 8 0
		Cash	5 1 6
	£8 3 9		£8 3 9

The profit on the 10½ months' working was thus £8 3*s.* 9*d.* Allowing half-an-hour a day for the work, this represents payment at the rate of a fraction over a shilling an hour.

The following table gives some interesting averages. The

number of birds is considered to be 17, no account being taken of the pullet which died in the first week:—

	Total. £ s. d.		Average. s. d.
Housing and equipment	3 0 3¼	...	3 7
Cost of food—10½ months	5 17 5½	...	6 11
Expenses (including loss on Sale of Birds, £1 4s. 10d., and Depreciation, 6s. 0½d.)...	2 2 2½	...	2 6
Profit	8 3 9	...	9 9½
Value of eggs	16 6 5	...	19 2½

During the year 1915-16, X worked on the same lines as before, with only minor modifications in her plan. She began work on the same day, receiving the birds on October 30, but this time she had 20 pullets instead of 18, and no deaths occurred. Four of the birds were pure white Leghorns; the rest were first crosses of heavy breeds: *viz.*, Minorca—Orpington, Faverolle—Orpington, Wyandotte—Orpington and Orpington—Wyandotte. All the fowls but one were laying when bought; the last one began to lay in January. As foods had been more expensive, X had to pay 5*s.* each for the fowls instead of 3*s.*, as in the previous year. Owing to earlier holiday arrangements, she was obliged to dispose of them in the middle of June, having thus a working year of only 7½ months. Three birds she sold to private purchasers at 4*s.* each, and the rest were sent to the London wholesale market where they realised from 2*s.* 3*d.* to 3*s.* 6*d.*, chiefly the latter figure.

A little side-line suggested itself, through a request which X received for day-old chicks. Again, without any previous experience, and following only her friends' advice, she set 12 eggs (Leghorns) on April 10. These cost 3*s.* 6*d.* The sitting hen broke 2 eggs, and from the rest were hatched 10 chicks, which X sold at 8*d.* each, thus making 3*s.* 2*d.* on the transaction. The broody hen was sold at 4*s.* with the chicks, so that there were no eggs to the credit of this bird after April 10.

The same foods were given as in the previous year, and the same methods followed, except that the morning feed of grain was often given in two parts: in the early morning, and at 11 a.m. This tended to make the birds more active. Foods were still dearer than in 1915, the total for the 227 days being £6 11*s.* 5*d.*, or 6*s.* 7*d.* per head, which is at the very high rate of 10*s.* 7*d.* per year, or, roughly, 2½*d.* per week. During this year, X kept particulars of the quantities of food bought, which were as follows:—

Wheat	340 lb.	Bran	90 lb.	Meat meal ...	56 lb.
Oats...	270 ,,	Sharps	190 ,,	Clover hay ...	76 ,,
Maize	60 ,,	Pea-meal	36 ,,	Mustard ...	13 ,,

Fifty-six lb. of flint grit, and 70 lb. of shell are also included in the above price of food. X had 8*s.* worth of food in hand at the beginning of the period, and 14*s.* 9*d.* worth at the end, so that the actual quantity of food consumed was a little under the above total of 1,131 lb. The quantity allowed each day was, as in the previous year, a fraction under 4 oz. per fowl.

The following tables give the details of the season's working:—

A.—Number of Eggs laid each Month.

Month.	*No. of Eggs.*	*Month.*	*No. of Eggs.*
October 30 and 31	17	*Brought forward* ...	... 1,159
November	288	March	321
December	275	April	333
January	291	May	349
February...	288	June (to 12th)	100
Carried forward ...	... 1,159		2,262

This result curiously resembles that of the preceding year, being (except for fractions) an average of an egg every other day, or 182 per year. The least number of eggs on any one day was 3, on November 1, December 6 and 23, and the highest 15 on April 11 and May 5.

B.—Highest and Lowest Wholesale Prices.

Price.	*Date.*	*Total for Eggs.*	*Average price per dozen.*
9 per 2*s.* ...	20th November—15th December	£17 9 3	1*s.* 10*d.*
9 ,, 1*s.* ...	31st March—30th April		

C.—Trading Account—30th October, 1915—12th June, 1916.

	£ *s.* *d.*			£ *s.* *d.*	£ *s.* *d.*
To Eggs for Sitting ...	0 3 6	By Sale—			
,, 20 Pullets at 5s. ...	5 0 0	Day-old chicks			0 6 8
,, Food £6 18 2		3 Fowls, 4*s.*		0 12 0	
Add Food in hand 0 8 0		6 ,, 3*s.* 6*d.*	£1 1 0		
		6 ,, 3*s.* 3*d.*	0 19 6		
		5 ,, 2*s.* 3*d.*	0 11 3		
7 6 2			2 11 9		
Less Food remaining 0 14 9		*Less* Carriage	0 4 8	2 7 1	
	6 11 5				2 19 1
,, Carriage of Pullets	0 4 6	Eggs			17 9 3
,, Straw litter ...	0 1 2				
,, Grass seeds for run	0 1 0				
,, Whitewashing poultry-house ...	0 1 6				
,, Sundries	0 1 0				
,, Balance c/d ...	8 10 11				
	£20 15 0				£20 15 0
,, 10 per cent. Depreciation on Plant, £3 0*s.* 3½*d.* ...	0 6 0½	Balance b/d			8 10 11
,, Interest (for one year) at 5 per cent. ...	0 3 0				
,, Capital	8 1 10½				
	£8 10 11				£8 10 11

D.—Balance Sheet as on 12th June, 1916.

Liabilities.	£ s. d.	*Assets.*	£ s. d.	£ s. d.
Capital, October 31st, 1915	8 6 9	Plant	2 14 3	
From Trading Account ...	8 1 10½	*Less* ...	0 6 0½	
				2 8 2½
		Stock of Food...		0 14 9
		Bank	5 0 0	
		Cash	8 5 8	
				13 5 8
	£16 8 7½			£16 8 7½

E.—Average Values (20 Fowls).

	Total. £ s. d.		*Average.* s. d.
Housing and equipment	2 14 3	...	2 8½
Cost of Food—7½ months...	6 11 5	...	6 7
Expenses (including loss on Sale of Birds, £2 0s. 11*d.*, and Depreciation, 5*s.* 6*d.*)	2 16 1½	...	2 9½
Profit (including profit on day-old chicks, 3*s.* 2*d.*)	8 1 10½	...	8 1
Value of eggs	17 9 3	...	17 5

The time spent over the work during the 7½ months was 113½ hours; the profit earned was thus at the rate of 1*s.* 5*d.* per hour—5*d.* per hour more than in the preceding year.

The work of the two seasons sufficiently demonstrates the possibilities that lie in poultry-keeping on a small scale. X had an advantage in having the birds at no greater cost than if she had reared them herself, but even if she had, for example, in the second year paid 7*s.* 6*d.* each for the pullets (leaving 2*s.* 6*d.* per bird as profit for the breeder) she would herself have realised a total profit of £5 12*s.* or 1*s.* an hour for her work. It must be remembered, too, that X made this profit after purchasing practically all the food. There are numerous households where house-scraps would reduce the food bill very considerably—in many families the scraps alone, with the addition of a little meal, would be sufficient to keep at least half-a-dozen hens.

POULTRY RUNS IN URBAN DISTRICTS.

EDWARD BROWN.

FARMERS, small holders, allotment holders, cottagers, and rural residents generally, must always be the chief producers of eggs and poultry, by reason of their greater opportunities. Many persons, however, who live in urban and suburban areas, even if they have no more than a back-yard or a few square feet of earth at their disposal, can profitably keep half a dozen hens, and so supply eggs for their

own households. Individually the production would be small; but in the aggregate it would be great. Already something is done in this way, but there is room for extension in all the great centres of population.

Many open spaces, such as vacant building land, could be used for poultry, and, if let for a definite period to those living near, could be made to produce food instead of lying waste. Much more could also be done in the way of poultry-keeping on town allotments, and railway employees might obtain permission to keep poultry on the sides of railways.

Limitations.—It should be stated at once that the system has its limitations, and these must be recognised if success is to be achieved. Attention may be directed to the following important points:—

Six hens can be kept profitably upon a space of 15 ft. by 6 ft., if the plans recommended below are adopted and if management is careful and systematic. A dozen birds kept in the same space would probably fail to produce an equal number of eggs. A male bird should not be kept, as he will consume food without giving any return, and his crowing may be a source of annoyance to neighbours. In any case it is probably undesirable to use the hens as breeding stock, as the conditions under which they are kept will probably not conduce to constitutional vigour. The hens should be kept purely for laying purposes, the required number being maintained by the purchase of pullets. Where additional ground is available in gardens, a setting of eggs for hatching, or a dozen day-old chicks, may be bought, and chickens raised, the pullets being selected as layers. As a rule it will not be necessary to renew the flock of hens more frequently than every second year. An excellent plan is to replace half the flock each autumn.

Exercise is essential to health, and part of the food, therefore, should be buried in scratching material. The exercise obtained in this way promotes an increase of egg production, gives employment to the birds, conduces to their contentment, and maintains vigour.

In order to minimise the risk of offence to neighbours, the poultry house and run should be placed as far as possible from any dwelling.

In order to comply with the requirements of the local authorities absolute cleanliness must be observed in house and run. Unless great care is taken to prevent conditions antagonistic to public health arising, the authorities are likely

to prohibit the keeping of poultry in proximity to dwellings. Food, especially in the form of decayed vegetables, should not be allowed to lie on the ground.

Houses.—What is known as the scratching-shed type of house is preferable for fowls kept in back-yards or gardens. By this is meant a shed sufficiently large to allow, in addition to the space required for perches and nests, two-thirds of the floor space to be bedded with scratching litter, and also to provide shelter in unfavourable weather. One of the chief dangers of keeping poultry in close confinement is that, unless they are compelled to take exercise, they may become fat and indolent, and the egg yield will suffer. To ensure abundance of ventilation the front of the house, facing south, south-east, or south-west, should be formed mainly of wire netting, with a shelter flap to carry off rain. A useful size of house for 6 hens is 6 ft. from front to back, 5 ft. wide, and 5 ft. high in front sloping to 4 ft. at back. One perch at the back will be enough, and two nest boxes at one side will complete the fittings. Such a house should be raised on bricks or stones, the floor consisting of earth or beaten rubble. Further information as to building a house of this class will be found in the Board's Leaflet No. 294, which will be forwarded post free on application. This leaflet embodies specifications of various types of poultry houses which may be adopted to meet individual requirements.

Runs.—As a rule the city or suburban poultry-keeper must keep fowls within an enclosure all the time. For this purpose wire netting is the cheapest material for fencing. For the more active lighter breeds it may be necessary to enclose the top of the run also, but for heavier breeds that precaution is unnecessary. Where narrow strips of wood, or laths, can be obtained cheaply these are equally serviceable. It is important that the nature of the ground in the runs should be suitable, and that the ground should be kept in a satisfactory condition. In all cases it should be deeply trenched so that rain may pass through, and an under layer of gravel or broken bricks is desirable. If sand is obtainable the earth may be covered to the depth of several inches, both in run and house. One advantage of sand is that it is friable, and grain can be buried in it. Renewal of sand will only be required twice or thrice in the year, if it is regularly dug over. Failing sand, fine ashes can be used in the run, and cut straw or chaff may be used for litter on the floor of the house.

In larger gardens, where twice the amount of ground is available, say, 15 ft. by 12 ft. for half a dozen fowls, or proportionally as numbers are increased, the area should be divided, thus providing double runs, each of which will be used alternately for periods of, say, three months. In such circumstances the house should be so placed as to give access to each run when desired, and the runs should consist of well-dug soil. As each run is vacated it should be planted with quick-growing vegetables to exhaust the manure, and to produce green food for the birds. Even under such conditions it is desirable that the house be bedded with litter as stated above in order to provide exercise for the fowls.

Fowls to Keep.—Some of our most prolific breeds of fowls are pure white or very light in plumage. If kept in a small garden run the feathers speedily become soiled, especially in thickly-populated and manufacturing districts. Hence those varieties which have coloured plumage are to be preferred. Fortunately there are many varieties from which to choose. Among the best of the non-sitting breeds for this purpose are Black and Brown Leghorns, Anconas, Campines, and Black Minorcas, all of which are excellent layers. The four first-named must be given plenty of exercise or they will be restless under confinement. Of the general purpose breeds the Silver Wyandotte, Plymouth Rock, Rhode Island Red, and the old type of Langshan can be commended, provided that they are not fed too highly.

Feeding.—A fat hen cannot lay well, and birds which are too fat are wasting food. The birds should be periodically examined, therefore, to see that, while they are kept in good condition, they are not getting too fat. Household scraps, mixed with bran, or very coarse sharps, and chopped vegetables, prepared with hot water, and made crumbly moist, not sticky, may be given as the evening meal, of which the birds can be allowed to eat as much as they will clear up. In the morning, for each bird a handful of grain, consisting of barley, good oats, and dari, should be scattered in the litter within the house, or buried deeply in sand or earth in the run, thus compelling the hens to work before they eat. Every ounce of the food is thus assimilated, and there is no waste. The evening meal of sharps should be fed in wooden V-shaped troughs, which can be easily washed and cleaned.

Under the conditions indicated the chief lack is green food, which is indispensable for the maintenance of the health

of poultry. Where any garden ground is available this should be used, as far as practicable, for growing supplies for the fowls. Almost all forms of vegetables are valuable for this purpose, especially lettuces, kale, cabbages, etc. Where no part of the garden is available, sprouted oats, or other grain will form an excellent substitute (see this *Journal*, June, 1914, p. 263). Mustard-and-cress may be grown in boxes containing a thin layer of soil. By such means green food can be supplied all the year round. Green stuff may be given as a mid-day meal, and a useful arrangement is to hang vegetables in a net just within reach of the birds.

A bucket of water, filled every day, should be placed in a corner of the house with a sloping board above, leaving sufficient room for the bird to introduce its head. The board is to prevent the hens standing on the edge of the bucket. A dust-bath, filled with fine ashes, to which may be added a little pyrethrum powder, will complete the equipment.

General.—Cleanliness in houses and runs is of supreme importance, and the birds should be kept free from parasites.* The house should be swept out regularly, the manure removed at stated intervals, the walls should be lime-washed, and the food and water vessels cleansed daily. The provision of a dust-bath will enable the birds to free themselves from parasites.

Parasites multiply very rapidly where birds are kept in strict confinement, and can only be kept down by the methods recommended.

No soft food should be allowed to remain after the birds are satisfied at each meal.

Occasionally, say twice a week, a tablespoonful of powdered vegetable charcoal for every six hens may be mixed with the soft food.

Grit, as sold by corn dealers, or fine-broken stones are essential for effective food digestion, and must always be in a box within reach of the fowls.

During the moulting period cast feathers should be swept up daily.

While the conditions of strict confinement, under which the fowls are kept, are not suitable for table fowls, ducks, geese, or turkeys, half a dozen laying hens may reasonably be expected to produce from 700 to 800 eggs yearly at a cost of from 4*d*. to 6*d*. per dozen.

* See Leaflet No. 57.

THE PULLING OF FLAX IN SOMERSETSHIRE.

Communicated by the British Flax and Hemp Growers' Society, Limited.

THE British Flax and Hemp Growers' Society, which was formed to administer grants from the Development Fund for the purpose of reviving flax and hemp growing in this country, was faced this summer with a more serious shortage of labour in the Yeovil district than had been anticipated earlier in the year. More than 100 acres of flax for fibre production had been grown under contract by the farmers in the district, and splendid crops had been raised, but there seemed to be little likelihood of the farmers being able to harvest the crops themselves.

It may not be generally known that when flax is grown as a fibre crop it is necessary to pull the long straws from the ground, taking care that they are kept uniform and parallel. The operation of pulling is both slow and laborious, as it has to be done by hand, because there is at present no machine which will perform this operation satisfactorily.

Although the Society was under no obligation to do more than assist in the pulling of the crops by using their Belgian staff for this purpose, it was found necessary to undertake practically the whole of the harvesting operations in view of the growing scarcity of farm labour.

The Yeovil Local Committee of the Society were empowered by the Central Committee to consider the employment of (1) Enemy prisoners, (2) British soldiers, and (3) Casual women labour for the purpose, and to make the necessary arrangements for undertaking completely the harvesting operations in that district.

In view of the nationality of their flax staff the Yeovil Committee decided that it would not be expedient to employ enemy prisoners for the work, even if they were forthcoming. They therefore made enquiries through the Labour Exchange for casual female labour, but found a sufficient number of women was not to be relied upon, while the matter of transporting them daily several miles from the town to the fields made this form of labour difficult to manage.

The Society then applied to the Military authorities for soldiers and explained at the same time the nature of the case, but they were informed that no soldiers would be available. It was therefore decided to adopt Lord Selborne's suggestion

and get senior boys from one of the larger schools in the country to take part in the harvesting of the flax.

Bristol Grammar School Boys.—The Bristol Grammar School authorities were approached, and, after consideration, undertook to render all the assistance in their power, as the work was recognised as being of national interest and that the revival of flax growing might prove to be of great benefit to the south-west part of the country. A company of 60 strong boys, varying from 15 to 18 years of age, volunteered for the work.

The use of this kind of labour for agricultural purposes having been advocated in several quarters it will be of interest to place on record a short account of a well-organised experiment of the kind.

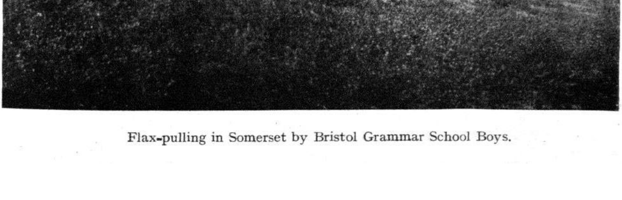
In view of the fact that the flax existed in patches varying from 2 to 6 acres, situated in different parishes, which were often separated from one another by a distance of 3 or 4 miles, it was decided to form a camp at a central position where the boys could live in semi-military fashion.

The Yeovil Committee, composed of farmers and flax spinners of the district, took a lively interest in the arrangements. They selected a splendid site for the camp in a sloping field at South Petherton, close to a river, and provided every possible convenience to make it a good camping ground.

In so far as the camp organisation was concerned the school submitted an estimate of the cost, undertook all responsibility, and made excellent arrangements. A small advance party with baggage travelled by train, and the remainder of the party cycled from Bristol to South Petherton. A master accompanied the boys to act as quartermaster, and undertook the organisation of supplies; another master went as commandant of the camp, and the school sergeant acted as cook.

The boys rose at the sound of the bugle at 6.45, and put the camp in order before breakfast, which was served at 8 a.m. By 9 a.m. the whole company, with the exception of a small camp party, left on their bicycles for the flax fields, which were generally situated some three or four miles away. Wherever pulling was in progress one of the Belgian staff was present to supervise the operation. Pulling was continued until 1 p.m., when there was an interval of an hour for lunch, which was brought to the field. At 2 p.m. work was resumed and continued until 5.30 p.m. The pulling proceeded on organised lines, and as soon as one field was finished there was a migration to some other farm where the same arrangements were followed. Camp was generally

Flax-tying in Somerset by Female and Boy Labour.



Flax-pulling in Somerset by Bristol Grammar School Boys.

reached again at 6 p.m., when the boys bathed in the river and had dinner under the trees.

During the whole period, nearly three weeks, the weather was very hot indeed, making it particularly trying to those unaccustomed to prolonged exposure to the sun. The ground was baked and the work was hard for hands that were naturally too soft, and had at all times to be protected by gloves, and for backs unused to constant stooping. The boys worked better at the end than at the beginning, which showed that they did not flinch from the labour. It is very creditable that no boy grumbled at the actual task, whatever may have been said in camp afterwards, but the work is too laborious and monotonous for boys.

With the wonderful powers of recuperation enjoyed by boyhood the workers who at 5.30 p.m. had been quite exhausted were at 7.30 p.m. washed, clean and in high spirits, and from 6 p.m. until lights were out at 10 there was no more cheerful place in the Kingdom than the camp at South Petherton.

Women's Labour.—It has been mentioned that at the time of making the necessary arrangements a sufficient number of women was not found willing and able to undertake the flax pulling. After it became known that other plans were being made, and no difficulty was apprehended in getting the necessary number of boys for the work, a greater number of women became available, and by the time the harvest operations commenced—about the 20th July—the number of women prepared to take up the work was so considerable as to allow a selection being made of a sufficient number to deal adequately with all the crops situated within a moderate distance of Yeovil. This reduced the time of pulling considerably, and facilitated the arrangements with the boys, who were thus not called upon to go far outside the South Petherton district.

Where possible the women walked to and from the fields, but where the fields were situated beyond a convenient distance from the town a motor char-à-banc was provided to take them out and fetch them back in the evening. Each gang of women was under the charge of one of the Society's permanent staff, who took part in and supervised the work. The crowd assembled was a motley one, only two persons having pulled flax before; in fact, agricultural work was new to most of them.

Generally speaking the women worked well and were not averse to being instructed. Those fresh to agricultural work were observed to be suffering from the monotony of the work more than from its being arduous. It soon became possible,

however, to pick out a number of the women who were working well and to offer them piece work, which they readily agreed to. The rate of pay agreed upon was 30s. per acre for pulling, it being understood that a minimum earning of 15s. per week would be granted while the work lasted. After this change had been made other women expressed their readiness to work under similar terms, and by this means the best workers were selected out while the remainder were not employed further. This arrangement worked well, and a number of the women were kept on after the pulling was completed for the purpose of tying up the flax straw into bundles after it had dried sufficiently in the field.

Turning to the financial arrangements, in so far as the boys were concerned it has been mentioned that an estimate was submitted covering the entire cost of the camp apart from equipment, and the items comprising the estimate were very modest. The catering was arranged at 1s. 6d. per head per day, and was admirable; the transport of camp equipment together with incidental expenses brought the total up to £125. This cost works out to about 15s. per week per boy. When the pulled area is taken into consideration the cost per acre of flax pulled is found to be £2 10s. In view of the fact that this figure includes the transport of the pullers on their own bicycles from one field to another, it does not compare so unfavourably as appears at first with the cost of pulling when done by women at 30s. per acre, exclusive of transport charges, the cost of which has been calculated to be equal to £1 15*s. per acre extra.*

Quite apart from a comparison of cost it is recognised by those who were concerned with the arrangements, and by those who had an opportunity for watching the experiment, that the entry into the district of a company of voluntary workers who were thoroughly determined to "stand in" and do their best because there was need, exercised a marked effect upon the people of the district. Probably without this stimulus it would not have been possible to get together so many womenfolk for arduous field work of an unusual character.

The Society welcomes the opportunity afforded here for placing on record this short account of their experience this year, in the full knowledge that it redounds greatly to the credit of the workers of Bristol Grammar School, and in the hope that it may prove a useful guide to others who may contemplate making a similar experiment.

PLUM APHIDES.

THE following article on Plum Aphides, subsequently to be issued in leaflet form, has been prepared by Mr. J. C. F. Fryer, the Board's Entomologist.

LEAF-CURLING PLUM APHIS (*Aphis pruni*, Réaumur).

Nature of Damage.—The presence of this aphis is easily recognised by the characteristic curling of the leaves (see Fig. 1) which are often covered with sticky honey-dew. In a bad attack the leaves die, the new growth is checked, and the fruit is either undersized or falls off before it is ready to pull. The aphides themselves live in the curled leaves.

Plants Attacked.—All varieties of plum and damson are attacked, and also blackthorn, peach, apricot, and apple, though to the three last little damage is done.

Life-History.—In the autumn small, shining black eggs are laid on the twigs and at the base of the buds. Early in spring—either in March or April, according to the district—these eggs produce young, which grow into large purplish or brownish "mother queen" aphides. The queens give rise to living young, which at first are green, but when full grown are often dark in colour. These aphides, which are also of the female sex and are wingless, produce young in their turn, and reproduction in this manner continues until late June or July, when winged forms appear. The winged forms desert the plums, but the plants to which they fly are not known with certainty, though it is said that they have been found on such weeds as thistles and ragworts (Natural Order *Compositæ*). Winged forms again appear on the plums in autumn, and these give rise to males and females, the latter producing the winter eggs.

Natural Enemies.—The plum aphis is attacked by lady-birds, lacewing and syrphid flies, as well as by minute hymenopterous parasites, but these natural enemies do not become very numerous until the aphis attack is at its height. It must not be thought, however, that they do no good, since by killing off vast numbers of the aphides they tend to prevent a severe attack the following year.

*Control Measures.**—This aphis can be controlled by spraying, but it is of the utmost importance to spray early in the season. When the leaves have once been curled little can be done.

* See Theobald, *Insect Pests of Fruit*, p. 382; Petherbridge, *Journal of the Board of Agriculture*, Vol. XXI., p. 917; Fryer and Berry, *Journal of the Board of Agriculture*, Vol. XXII., p. 1125.

Lime-washes applied in late February or March have been found effective, the later applications giving the best results. The aphides may also be controlled by means of contact insecticides, such as nicotine and soft soap, quassia and soft soap, or paraffin emulsion, the spray being applied just before the blossom opens or after the petals have fallen, but, in the latter case, before the leaves have been curled. A close watch is required in order to discover the attack in its early stages.

MEALY PLUM APHIS (*Hyalopterus pruni*, Fab.).

Nature of Damage.—Although serious damage is sometimes reported as being due to this aphis, it is, as a rule, far less harmful than the Leaf-curling Plum Aphis. It seldom occurs on the plums before midsummer, and is found on the underside of the leaves, on the leaf stalks, and young growth, but it produces no curling of the leaves (see Fig. 2). It secretes abundant honey-dew, however, which, falling on the leaves and fruit, may do considerable damage.

The aphis may be recognised by its light green colour, by the waxy or mealy secretion with which it is covered, and by the facts that it occurs late in the season and does not curl the leaves.

Plants Attacked.—It attacks plums of various kinds, greengages, damsons, peach, nectarine, apricot, and other species of *Prunus*. It is very probable that it also lives on reeds and grasses.

Life History.—The life history of the Mealy Plum Aphis has not yet been followed in this country. It is chiefly found on plums during the latter half of summer, and there is a strong probability that the remainder of the year is spent on grasses and reeds. In Russia and in the United States of America it is said to live during the winter and early summer on plums and the rest of the year on reeds, but it can hardly have a similar history in Britain.

Natural Enemies.—The remarks under this heading on the Leaf-curling Plum Aphis apply also to the present species.

*Measures of Control.**—The best wash for use against the aphis is said to be a paraffin emulsion containing liver of sulphur.

Some washes fail owing to the fact that they cannot penetrate the mealy secretion by which the insects are covered.

HOP DAMSON APHIS.

This aphis is treated fully in Leaflet No. 88, and need only be dealt with quite shortly. It is found in injurious

* Theobald, loc. cit., p. 385.

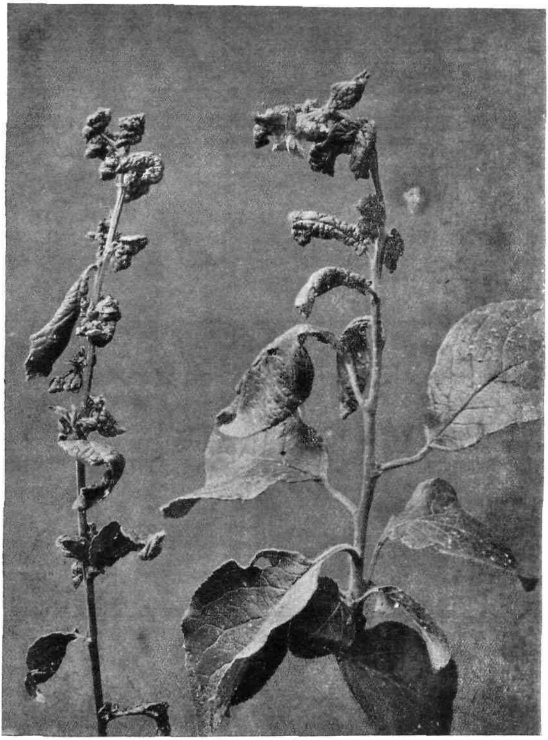


Photo:—R. A. Malby

FIG. 1.—Plum twigs attacked by aphides. The upper leaves have been curled by the Leaf-curling Plum Aphis; the lower leaves show the presence of a few Mealy Plum Aphides.

numbers chiefly on the damson, but it occasionally occurs on other plums. The life history is briefly as follows: Eggs are laid on the damsons in autumn, and, on hatching in early spring, produce aphides which live for 3 to 5 generations on the damsons. Towards the end of May, winged forms appear which desert the damsons and fly to hops. There is a return migration to the damsons in autumn. By sucking the juices of the damson these aphides may do considerable damage, while they are also the cause of the notorious hop blight. In hop-growing districts, therefore, it is very necessary that the aphis should not be allowed to multiply when on the damson. The same measures of control may be employed as were suggested in the case of the Leaf-curling Plum Aphis.

SPRAY FORMULÆ.

*I.—Lime Wash.**

Quick-lime	10–20 lb.
Water	10 gal.

If possible, the best Buxton quick-lime should be used, and the proportion of lime to water should be as high as is consistent with convenient spraying of the resulting wash by the apparatus available. In making up the wash sufficient water should be poured on to the lime to keep it covered until it is slaked. After slaking, the remainder of the water should be added, the whole well mixed, and strained into the spraying machine. Lees advises that the lime should be allowed to slake for from 6 to 12 hours, while other authorities recommend ½-hour only, before it is used.

If it is desired to use lime-sulphur instead of plain lime-wash it is suggested that the concentrated solution should be obtained from the manufacturers, unless it is required for use on a large scale, when it may prove economical to make it locally.

II.—Nicotine Wash.

Nicotine, 98 per cent.	¾–1 oz.
Soft soap	½–1 lb.
Water	10 gal.

The nicotine and soap are dissolved in the water. The soap may be first mixed with a little hot water in order to dissolve it more quickly.

III.—Paraffin Emulsion.†

Paraffin	1 pint.
Soft soap	1 lb.
Liver of sulphur (if needed) ..	2 oz.
Water	10 gal.

* Lees, *Annals of Applied Biology*, I., p. 381. Petherbridge, loc. cit.

† Lees (Annual Report of the Long Ashton Research Station, 1913, p. 71), suggests this formula, but without the liver of sulphur.

The soap should be dissolved in about 1 gal. of boiling water and the paraffin added while the liquid is still hot. The mixture should be thoroughly churned, preferably by spraying it back into itself with a hand syringe. The remainder of the water, in which if necessary the liver of sulphur is dissolved, should then be added, and after it has once more been thoroughly churned the fluid is ready for use. Unless it is completely emulsified paraffin emulsion is liable to burn delicate foliage, and it should, therefore, be prepared and used with care. It has, however, the very marked advantage that the necessary ingredients are always easily obtainable.

Formulæ for making other contact insecticides, such as resin wash or quassia, may be obtained on application to the Board. Under certain circumstances it is convenient to use a proprietary contact insecticide to avoid the trouble of preparing the home-made washes.

THE REARING OF ANGORA RABBITS FOR THEIR WOOL.

L. E. MOORE.

THE rearing of Angora rabbits for the production of wool is one of the profitable small industries of France, the value of the wool obtained from this source amounting to as much as £40,000 per annum. The industry owes its development chiefly to the efforts of M. Patard-Châtelain, who has erected a large factory for the purpose of weaving the wool into the delightfully warm garments worn by children and invalids and by those who indulge in winter sports. The demand for these garments is very great, and the rabbit-keeper obtains a good price for his produce.

Type of Rabbit Required.—Careful breeding is necessary to secure the best type of rabbit for wool production. The main object which the breeder keeps in view is to combine size of body with length of hair. The breeding stock should be selected from the rabbits possessing the longest and most abundant hair. Size is also ensured by limiting to four the number of young reared by the doe; any in excess of this number are given to a foster mother.

Housing and Feeding.—As the Angora is very susceptible to cold, warm housing is essential. A suitable place is a warm stable or cowhouse out of reach of disturbance by children or noisy dogs. The hutches, which should stand in tiers, must only be sufficiently large for the rabbits to turn round in; if more

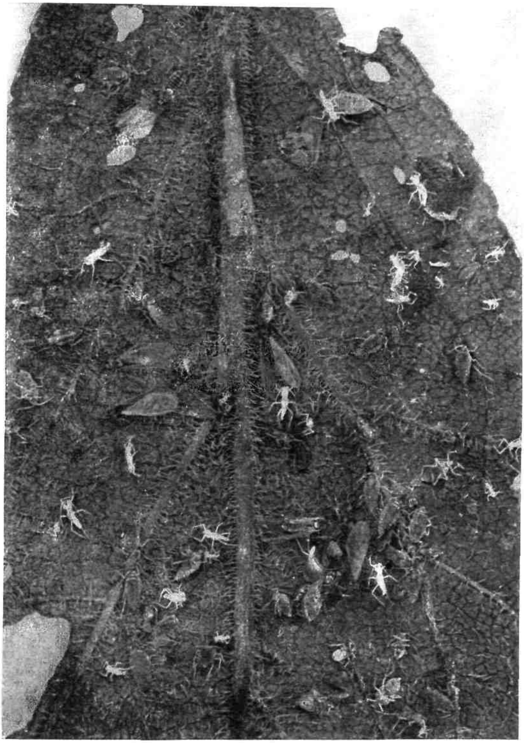


Photo :—*R. A. Malby.*

FIG. 2. Plum leaf (greatly magnified) attacked by the Meally Plum Aphis, showing winged and wingless forms, and also cast skins. It will be noticed that the leaf has not been curled.

room is given there is a tendency for the wool to become matted and useless. Large runs on the ground are also undesirable, as the rabbits become dirty, fight, and tear one another's hair.

The young rabbits should be given a nourishing and soothing diet. Among suitable foods are clover or clover hay, cabbage (excepting cauliflower leaves), and mashes of all kinds; maize meal is particularly suitable. Bran should not be fed under any circumstances, as it may cause digestive trouble, and grain should be avoided until the rabbits are four months old, when they may be given the adult diet.

The general feeding of the adult rabbit will depend upon the circumstances of the rabbit-keeper. The cottager will endeavour tō obtain the greater part of the food required from the roadside and hedgerow. The rabbits are not exacting, and many weeds, such as dandelion, plantain, cow parsley, chickweed, dock, etc., may be collected with advantage. Lawn cuttings given green also form a useful food, and these may often be obtained for the trouble of fetching them. Farmers or gardeners in the neighbourhood may be willing to give the rabbit-keeper small quantities of carrots too small for sale, swedes, etc., in return for some slight assistance.

The smallholder who keeps rabbits should endeavour to grow all the feeding stuffs required—fodder crops, grain, roots and cabbage—on his holding. Clover, trefoil and cow cabbage are the most important. Clover and trefoil may be used in the green state in summer and in the form of hay in winter. It is best to use only the second cutting for the rabbits. All green food should be gathered and dried the day before it is eaten.

The doe should be provided with a good nest of straw five days before she is due to kindle, and for a week before that time, and until she has finished suckling her young she should be given no dry food, but only green food and meal mashes. As soon as the sex can be discovered all the males not required for breeding should be castrated; they are then not only more gentle to handle but furnish a larger quantity of wool which is easier to pluck.

Plucking.—It is necessary first of all to rid oneself of the idea that plucking the wool entails any cruelty towards the rabbit. If the wool is left unplucked it will fall out naturally; the rabbits also tear it off with their teeth and the doe uses it to make her nest. So little inconvenience does the operation cause the rabbit that it will often sit and eat contentedly while the operator is at work.

The operation is performed in the following manner. For the

first time and until the rabbit becomes accustomed to the plucking the operator places it on one knee—preferably the left—the head facing his body. The legs should then be placed astride one on each side of the thigh and the left hand of the operator rested on the back with the wrist pressing slightly on the rabbit's head to prevent it biting. A small piece of the skin of the neck is held between the left fore-finger and thumb while two or three hairs are pulled out with the right hand. If the hairs do not come away easily or the skin is reddened they are not "ripe" for plucking and the operation must be deferred for a few days; otherwise, the skin, which is very fine on the young rabbit, may be torn. The hair should always be pulled in the direction it grows, that is, from head to tail on the back and underneath, and from back to underneath on the sides.

After the operation the rabbits must be put back into a warm nest. To prevent the rabbit catching cold it is best in this country first to pluck the wool from the upper portion of the body and then after an interval of 45 days to pluck the under portion. Except for the head and feet the wool must be completely removed every three months. However badly matted it may be the wool should on no account be cut with scissors. The women who do the plucking take from 25 to 30 minutes to pluck a rabbit completely.

The young ones should be plucked when they are from 3 to 6 weeks old at the time they leave the mother, and then placed in hutches in twos; they must be plucked again at $3\frac{1}{2}$ months old, when each should be placed in a separate hutch. The third plucking is carried out after an interval of $2\frac{1}{2}$ months and the fourth after a further interval of 3 months. Afterwards they are plucked every 3 months. The does should be plucked a month before kindling and again when they leave their young.

The greatest quantities of wool are obtained during the first 3 years; at 4 years of age the rabbits should be killed, plucked, and sold for eating.

Marketing.—So far as the writer has been able to ascertain English buyers of the wool will not take quantities of less than 1 cwt. If the industry is developed to any extent in this country, there will no doubt in time be greater facilities for disposing of the produce. In the meantime M. Patard-Châtelain is willing to take even the smallest consignments. The price given will vary according to the quality, 18*s*. per lb.* being paid for the very best quality and 12*s*. to 13*s*. per lb. for average quality. In proportion as the wool is shorter or more matted the price diminishes; wool which is very much matted is valueless. The

* The prices quoted in this article, and subsequent particulars as to conditions in France, relate to the year [illegible]

manufacturers prefer the wool to be as long as possible and attach much more importance to this than to fineness. The highest prices are obtained for white wool, but as the black rabbits carry a heavier coat there is little to choose between the returns yielded by each kind. If no attempt is made to grade the wool the price obtained will average about 9*s*. per lb. It is seen, therefore, that any time spent in grading will be well repaid. When marketing the wool the different colours and qualities should be kept distinct. If any is slightly matted it should be saved and sent by itself when a sufficient quantity has been collected. The wool should be enclosed in a clean, white cotton bag and tied securely at the neck with a label giving the name and address of the sender, the date of despatch and the weight of the contents. The whole should be enclosed in a strong wrapper and sent to M. Patard-Châtelain, Lons-le-Saunier, Jura, France.

The wool should be sent by parcel post *valeur déclarée*. This will cost a little more than ordinary parcel post, but it ensures against loss in transit. A letter or card advising M. Patard-Châtelain of the despatch of the parcel should be sent at the same time.

General Considerations.—There are three classes of rearers:—

1. Cottagers and others who keep a small number of rabbits and depend upon the scraps from the house and garden-stuff supplemented by dry forage and meal. On an average it may be taken that 50 rabbits kept in this way at a cost of £3 10*s*. per year for food will bring in about £16 10*s*. Many of the rabbit keepers supplying M. Patard-Châtelain, who have no land beyond cottage gardens, send him wool to the value of £25 to £48 a year.

2. Smallholders who can grow all the foodstuffs required on their holding. This class should also find the industry a remunerative one.

3. Those who keep the rabbits on a larger scale. These may keep from 2,000 to 5,000, employ labour, and devote their whole time to the work.

The amount of wool produced by a single pair of rabbits and their offsprings in the course of a year will be, on an average, as follows:—

Parents	20 oz.
1st family	18 ,,
2nd ,, ...	5 ,,
3rd ,, ...	1 ,,
2 families from 1st family ..	7 ,,
	51 oz. or about 3 lb. at 10*s*. a lb.

It is difficult to give an accurate estimate of the cost of rearing the rabbits; so much depends upon the circumstances in which they are kept, but it is instructive to give the results obtained on a small holding in France. The rent of the 17 acres constituting the holding is £42; from 9½ acres of this are produced 105,000 lb. of roots and cabbage, and 48,900 lb. of dry forage. This supplies sufficient food for 1,200 head of rabbits for the 5½ winter months. Seven and a half acres are retained under grass and are utilised for summer feeding. As regards labour one lad is employed to help with cultivating the crops and two girls to pluck and feed the rabbits. Reckoning the average cost of the three at 9*s.* the total expenditure on labour will be £70 4*s.* or, with rent, £112 4*s.*

At a moderate calculation the rabbits should yield 656 lb. of wool. If this is sold at an average price of 10*s.* per lb. the receipts would be £328; this leaves a balance of £215 16*s.* after deducting rent and labour, but from this must be deducted the cost of seeds, etc.

In conclusion, a word of warning is necessary against commencing rabbit-keeping for wool production on too large a scale. To do so is to court failure. Success can only be attained by beginning in a small way and gradually increasing the number of rabbits kept as experience is gained.

Cheese-Making More Profitable than Butter-Making.

SINCE the importance of producing more food in this country has become so apparent, county education authorities have, at the instigation of the Board, advised the manufacture of cheese from surplus milk, and the making of cheese in place of butter. To this end most county authorities are now providing suitable peripatetic classes and demonstrations. This work is not only of importance from a national standpoint, but cheese-making is of advantage to the producer, inasmuch as it pays better than most other methods of conserving milk as a food.

In carrying out the instruction mentioned it is customary for the instructresses to demonstrate the actual returns obtained in butter and cheese from equal quantities of milk. The attention of the Board has been drawn to the results obtained at some of these demonstrations conducted at certain centres in Somerset during the early part of this season. At each of these centres equal quantities of milk were made—the one

into cheese, and the other into butter—and the products were valued at the prices current, at the time, in the respective districts.

The returns were as follows :—

OTHERY CENTRE.

February 9th, 1916.—6 gal. Milk produced 7 lb. 2 oz. Caerphilly Cheese.

February 10th, 1916.—6 gal. Milk produced 1 lb. 10 oz. Butter.

Returns :—			*s.*	*d.*
7 lb. 2 oz. Caerphilly Cheese at 1*s.* per lb.			7	1½
5 gal. Whey at 1*d.* per gal.			0	5
	s.	*d.*	7	6½
1 lb. 10 oz. Butter at 1*s.* 8*d.* per lb.	2	8½		
*1½ gal. Butter-milk at ½*d.* per gal.	0	0¾		
5½ gal. Skim Milk at 2*d.* per gal.	0	11		
			3	8¼
Extra profit from Cheese-making			3	10¼

LOW HAM CENTRE.

March 1st, 1916.—6 gal. Milk produced 6 lb. Caerphilly Cheese.

March 2nd, 1916.—6 gal. Milk produced 1 lb. 10 oz. Butter.

Returns :—			*s.*	*d.*
6 lb. Caerphilly Cheese at 1*s.* per lb.			6	0
5 gal. Whey at 1*d.* per gal.			0	5
	s.	*d.*	6	5
1 lb. 10 oz. Butter at 1*s.* 6*d.* per lb.	2	5¼		
*1½ gal. Butter-milk at ½*d.* per gal.	0	0¾		
5½ gal. Skim Milk at 2*d.* per gal.	0	11		
			3	5
Extra profit from Cheese-making			3	0

HAMBRIDGE CENTRE.

March 29th, 1916.—6 gal. Milk produced 7 lb. Caerphilly Cheese.

March 30th, 1916.—6 gal. Milk produced 1 lb. 14 oz. Butter.

Returns :—			*s.*	*d.*
7 lb. Caerphilly Cheese at 1*s.* per lb.			7	0
5 gal. Whey at 1*d.* per gal.			0	5
	s.	*d.*	7	5
1 lb. 14 oz. Butter at 1*s.* 6*d.* per lb.	2	9¾		
*1½ gal. Butter-milk at ½*d.* per gal.	0	0¾		
5½ gal. Separated Milk at 2*d.* per gal. ..	0	11		
			3	9½
Extra profit from Cheese-making			3	7½

*See footnote next page.

KINGSBURY EPISCOPI CENTRE.

April 18th, 1916.—6 gal. Milk produced 6 lb. Caerphilly Cheese.
April 19th, 1916.—6 gal. Milk produced 1 lb. 12 oz. Butter.

			s.	d.
Returns :—				
6 lb. Caerphilly Cheese at 1s. per lb.			6	0
5 gal. Whey at 1d. per gal.			0	5
			6	5
	s.	d.		
1 lb. 12 oz. Butter at 1s. 8d. per lb.	2	11		
*1½ gal. Butter-milk at ½d. per gal.	0	0¾		
5½ gal. Separated Milk at 2d. per gal. ..	0	11		
			3	10¾
Extra profit from Cheese-making			2	6¼

YEABRIDGE CENTRE.

May 17th, 1916.—6 gal. Milk produced 6 lb. Caerphilly Cheese.
May 18th, 1916.—6 gal. Milk produced 1 lb. 10 oz. Butter.

			s.	d.
Returns :—				
6 lb. Caerphilly Cheese at 1s. per lb.			6	0
5 gal. Whey at 1d. per gal.			0	5
			6	5
	s.	d.		
1 lb. 10 oz. Butter at 1s. 6d. per lb.	2	5¼		
*1½ gal. Butter-milk at ½d. per gal.	0	0¾		
5½ gal. Separated Milk at 2d. per gal. ..	0	11		
			3	5
Extra profit from Cheese-making			3	0

Summary of five Returns.

Othery Centre	Extra profit from Cheese-making ..	3	10¼
Low Ham Centre ..	" " " ..	3	0
Hambridge Centre.	" " " ..	3	7½
Kingsbury Episcopi Centre	" " " ..	2	6¼
Yeabridge Centre ..	" " " ..	3	0
		16	0
Average Extra Profit from Cheese-making ..		3	2

or an extra return of slightly over 6d. per gallon for the Milk

Another demonstration given in the same county may also be mentioned. It was held in a farm-house dairy where, for several years past, the custom had been to skim the milk first for butter-making, and afterwards to make cheese from the skim milk. The results were as follows :—

* These 1½ gal. were diluted butter-milk consisting, approximately, of ⅓ gal. of actual butter-milk and the rest water. The allowance of ½d. per gal. for watered butter-milk is equivalent, therefore, to 2¼d. per gal. for undiluted butter-milk.

First day.—39 gal. of milk, made into butter and skimmed milk cheese in the usual way, produced :—

	£	s.	d.
12 lb. Butter at 1s. 7d. per lb.	0	19	0
18¾ lb. Skimmed Milk Cheese at 6d. per lb. ..	0	9	4½
	£1	8	4½

Second day.—39 gal. of milk made into Cheddar cheese produced :—

	£	s.	d.
37¼ lb. Cheddar cheese at 1s. per lb.	£1	17	3

The by-products, in the two cases, were of approximately equal value. There was shown, therefore, an additional return of 8s. 10½d., or, approximately, 2¾d. per gallon in favour of whole-milk cheese-making.

Experiments with the Overhead Electrical Discharge in 1915.*

THE following note has been communicated to the Board by Mr. Ingvar Jorgensen, of the Department of Plant Physiology and Pathology, Imperial College of Science and Technology, South Kensington :—

Experiments on Crop Production.—Experiments on the effect of overhead electrical discharges on crops were continued in 1915, a crop of oats being grown under this treatment at Lincluden Mains, Dumfries, by Miss E. C. Dudgeon.

The crop was grown on ground which had been used for the three previous years for similar experiments with potatoes. The experimental ground consisted of two plots each of 1½ acres lying side by side, one of them receiving the electric discharge, the other being used as the "control." The two plots were separated by a well-earthed wire screen reaching to a height three feet above the level of the charged network. It was hoped by this means to prevent any considerable leakage of current from the electrified area to the control. Readings of a sensitive electrometer showed that the screen much reduced the amount of discharge reaching the non-electrified area, but it did not do away altogether with the leakage.

The season was a particularly dry one, accompanied by a scorching sun, and as the soil is of a very porous nature the conditions were not conducive to a heavy crop.

From the early stages of growth the crop on the electrified area showed a marked superiority in comparison with that on the "control" area, and did not suffer from the prevailing drought to the same extent.

* Previous accounts of investigations will be found in this *Journal* for April, 1910, p. 16; January, 1912, p. 862; October, 1913, p. 582; and January, 1915, p. 944.

The discharge was run for 557 hours during 108 days, *i.e.*, for an average of 5 hours a day.

The two crops when ready for harvesting were cut, threshed and weighed separately. The weights of the two crops are given below, and show that the electrified crop, as compared with the non-electrified, showed the remarkable increase of 30 per cent. in grain and 58 per cent. in straw.

	Total grain.	*Total straw.*	*Increase of grain.*	*Increase of straw.*
Electrified ..	1300 lb.	2476 lb.	30 per cent.	58 per cent.
Control ..	1008 ,,	1572 ,,	—	—

Analysis of Crop.—An analysis of the grain and straw from the two crops grown at Lincluden, Dumfries, was undertaken by Miss M. Hewlett, B.Sc., at the University of Leeds, under the supervision of Dr. Crowther. The figures obtained for the experimental and control crops showed practically no differences apart from those accounted for by experimental error. Feeding experiments are needed before it can be concluded with certainty that the discharge has been without effect on the food value of the oats, but it is extremely unlikely that any difference would be demonstrated between the two crops.

Sulphate of Ammonia.

THE liklihood of farmers having to depend almost exclusively upon sulphate of ammonia as a source of nitrogen until the end of the War led the Board to institute an enquiry among farmers (through the medium of heads of agricultural colleges and agricultural organisers) as to their experience on various points with regard to the use of sulphate of ammonia.

Autumn Use of Sulphate of Ammonia.—Prominent among these points was the question of autumn use of sulphate of ammonia. Last year the Board drew attention to the old practice of top-dressing wheat in autumn, and recommended that in certain cases farmers should revert to this practice in respect of part of the nitrogenous dressing. It was pointed out that if the winter was moderately dry, and the spring dry and cold, autumn manuring would be likely to give the best results on poor land. The actual conditions experienced, however, were more favourable to spring dressings; nevertheless, in the few instances where sulphate of ammonia was applied last autumn farmers have expressed themselves as well satisfied with the results. Reports were received from seven farmers who had tried autumn applications only, and from a further six who compared autumn with spring applica-

tions. In regard to the autumn applications the crops (except in one case—winter oats) were wheat. The applications were made between the end of October and December at rates varying from ½ cwt. to 1¾ cwt. per acre, and the farms were in Yorkshire, Gloucestershire, Berkshire, Essex and Wales. In five cases the results were decidedly satisfactory. Where autumn applications were compared with spring applications the reports were in favour of spring dressing in three cases, of autumn dressing in two (unfortunately in one of these more sulphate was used in autumn), and in one there was no difference, despite a wet winter.

A report was received from Armstrong College of direct tests carried out on wheat at seven centres; at five of these centres early winter or autumn applications gave better results than spring applications. The advantage was particularly noticeable at one centre where wheat was grown after oats.

Winter Applications.—In nine cases reports were received of applications in winter, from the end of December until early in March, the quantities varying from 1 to 2 cwt., and the crops being wheat, barley and oats; in every instance the results were entirely satisfactory. Reports from several counties indicate that the month of January, when the plant was just coming through, proved a very suitable time for the application of sulphate of ammonia to wheat.

Spring Applications.—Some eighty farmers stated that they had used sulphate of ammonia in spring, in quantities varying from ½ cwt. to 2 cwt. per acre, on wheat, barley, oats, hay, mangolds, swedes, turnips, carrots, mustard and potatoes, and on a wide range of soils. The manure was generally covered in at seed time or at planting, but in several cases was top-dressed, as late as June and July with mangolds. The general consensus of opinion was that the earlier the top-dressing, the better. In no single instance was an unsatisfactory result obtained, and in most cases a decided improvement was recorded. Several farmers insisted on the need for harrowing in the sulphate of ammonia.

Comparison between Nitrate of Soda and Sulphate of Ammonia.—More than fifty farmers ventured opinions as to the relative merits of nitrate of soda and sulphate of ammonia for top-dressing in spring, and in most cases these would appear to be based on actual experience. In Worcestershire the majority of farmers preferred nitrate of soda for top-dressing cereals in spring, although sulphate of ammonia was used fairly extensively (with superphosphate) before drilling spring corn.

The remarkable fact elsewhere was that only about one-quarter of the opinions were in favour of nitrate of soda ; nearly one-half were to the effect that sulphate of ammonia was to be preferred, while the remainder stated that there was very little difference between the two. Sulphate of ammonia was very generally preferred for cereals, potatoes and roots.

The quickness of action of nitrate of soda is in some cases an advantage, enabling it to be applied later than sulphate of ammonia, at a time when the necessity (if any) of nitrogen for the crop becomes fully apparent. If it is a convenience to apply somewhat earlier in the year, the comparative slowness of action of sulphate of ammonia is a point in its favour. Sulphate of ammonia possesses the advantage that it may be applied at the time of sowing the spring-sown crops and harrowed in ; with a dry April and May there may not be sufficient rain to wash the nitrate of soda in, and the latter manure may lie on the top of the soil until too late to be of use. A point in favour of nitrate of soda is that it is not affected by the absence of lime from the soil. Many of the excellent results quoted above with sulphate of ammonia were doubtless obtained by farmers who were large users of basic slag, or whose land from other causes was not markedly deficient in lime.

It was mentioned in some instances that a better sample of grain, particularly barley, was obtained from the use of sulphate of ammonia than from nitrate of soda.

The report sent in by Armstrong College stated that sulphate of ammonia should probably not be applied as a top-dressing during frosty weather, especially if bright sunshine follows frosty mornings ; applications followed by damp, mild, growing weather will probably give the best results. Harrowing in the sulphate of ammonia at the time of sowing wheat, or its application as a top-dressing before the young plants are showing through the ground, obviates this risk.

Notes on Feeding Stuffs in October: *From the Animal Nutrition Institute, Cambridge University.*

THERE is a general rise in prices this month, in many cases amounting to as much as 3*d*. per food unit, corresponding to from 15*s*. to 25*s*. per ton. The only feeding stuffs which have fallen in price are American maize, Argentine oats, Calcutta white peas, English oats and Argentine maize. In spite of this, however, these feeding stuffs are still comparatively dear. It is somewhat remarkable to note that for some months past all foods rich in starch have been

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate prices per ton at the end of September.											
		London.			Liverpool.			Hull.			Bristol.		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d
Soya Bean Cake	122·3	13	6	3		—		13	5	0	13	10	[illegible]
Decorticated Cotton Cake	126·3	13	10	0	12	15	0		—			—	
American Linseed Cake ..	119·0		—			—		13	0	0		—	
Indian Linseed Cake ..	123·1		—		12	15	0		—			—	
Russian Linseed Cake ..	123·5		—			—		13	10	0		—	
English Linseed Cake ..	120·1	14	7	6	14	10	0	14	0	0	14	17	[illegible]
Bombay Cotton Cake ..	65·3	9	15	0	10	5	0	10	0	0	10	0	[illegible]
Egyptian Cotton Cake ..	71·9	10	2	6	10	15	0	10	10	0	10	12	[illegible]
Coconut Cake	102·6	*11	5	0	10	15	0		—		11	5	[illegible]
Palm-nut Kernel Cake ..	96·1	9	10	0	9	0	0	9	2	6	9	15	[illegible]
Palm-nut Meal (extracted)	92·5		—			—		9	0	0		—	
Ground-nut Cake ..	145·2	‡13	10	0		—		13	5	0	13	10	[illegible]
English Beans	99·5	†13	5	3	13	10	8	13	6	8	13	1	[illegible]
Chinese Beans	101·2	12	2	8	13	1	4		—			—	
English Maple Peas ..	97·2	§14	0	0		—		15	0	0		—	
English Dun Peas ..	97·2	§13	2	3		—		13	6	8		—	
Calcutta White Peas ..	97·5	§16	2	3		—		14	8	11		—	
American Maize	93·8	11	1	8	11	11	6	11	13	4		—	
Argentine Maize	94·2	11	13	4	11	6	10	12	0	4	12	12	[illegible]
Maize Meal	86·5	12	0	0	12	5	0	12	17	6	13	0	[illegible]
Maize Gluten Feed ..	121·6	11	12	6		—			—		12	7	[illegible]
Maize Germ Meal ..	99·2	11	15	0	12	0	0	12	0	0	12	10	[illegible]
English Feeding Barley ..	83·0	14	14	0		—		12	10	2	15	9	[illegible]
English Oats	75·4	10	13	4	10	15	8	10	6	8	10	0	[illegible]
Argentine Oats	75·4	11	15	9		—			—		10	6	[illegible]
Malt Culms	69·9	7	0	0	8	10	0	7	10	0	8	0	[illegible]
Brewers' Grains (dried) ..	84·5	9	0	0		—		8	10	0	9	0	[illegible]
Brewers' Grains (wet) ..	21·1	1	4	0		—		1	10	0		—	
Distillers' Grains (English)	101·2	9	5	0	10	10	0		—		10	5	[illegible]
Distillers' Grains (French)	101·2	9	5	0		—			—			—	
Egyptian Rice Meal ..	78·7	11	10	0		—			—			—	
Burmese Rice Meal ..	78·7	11	0	0	11	0	0		—		11	15	[illegible]
Wheat Middlings (coarse)	94·8	11	0	0		—		9	5	0	12	10	[illegible]
Wheat Sharps	90·5	11	5	0		—		12	5	0	11	10	[illegible]
Wheat Pollards	96·7		—			—			—			—	
Wheat Bran	77·5	8	0	0		—		8	10	0	7	15	[illegible]
Wheat Bran (broad) ..	79·9	9	0	0		—		9	10	0	8	15	[illegible]
Feeding Treacle	60·0	‖12	12	0	12	10	0		—			—	
Linseed	153·5	21	0	0	¶24	0	0	21	10	9	20	17	4
Linseed Oil	250·0	36	5	0	[1]42	0	0	36	5	0		—	
Egyptian Cotton Seed ..	108·6	12	11	3		—		13	0	0		—	
Bombay Cotton Seed ..	99·6		—			—			—			—	
Cotton Seed Oil	250·0	35	0	0	[1]42	0	0	[2]31	15	0		—	

* 2nd grade (London) £10 15*s*. 0*d*. per ton. † New Crop (London) £11 16*s*. 10*d*. per ton. § Old Crop. ‡ 2nd grade (London) £12 12*s*. 6*d*. per ton. ‖ 2nd grade (London) £10 10*s*. 0*d*. per ton. ¶ Cleaned. [1] In barrels [2] Crude.

excessively dear, whilst foods rich in protein and oil have been comparatively cheap.

The following are suggested rations for the month :—

Horses.—Although oats are somewhat cheaper than they have been they are still very extravagant food for farm horses.

The following rations may be used to replace 12 lb. of oats for horses of average size doing average farm work :—

I.—4 lb. Bran.	II.—4 lb. Bran.
4 lb. Dried grains.	4 lb. Maize.
2 lb. Maize gluten feed.	1 lb. Maize gluten feed.
1 lb. Linseed cake.	1 lb. Linseed cake.

Both rations are rather richer in protein and rather poorer in carbohydrates than oats, and this remark applies especially to I. It is almost impossible at the present time to buy foods rich in carbohydrates at a reasonable price. The cheapest source of carbohydrates is roots. Horses on the rations suggested above should get a stone of pulped roots per day mixed with their chaff. This will correct the excess of protein and the lack of carbohydrates in the rations. If the horses are called upon for extra work at any time, the ration should be increased. It is not advisable to add a more nitrogenous food, such as beans.

Cows.—For cows still out at grass the rations suggested last month may be continued. For cows which have come in for the winter the following suggestions may be useful. As additions to a ration of coarse fodder, consisting of about 4 stones of roots, ½ stone of hay and 1 stone of straw, the following mixtures are suitable and economical :—

I.—Ground nut cake	.. ..	2 parts.
Palm-nut kernel cake	.. .. ..	1 part.
Linseed cake	.. ..	1 ,,
Maize gluten feed	.. ..	1 ,,
II.—Ground nut cake	.. ..	1 ,,
Linseed cake	.. ..	1 ,,
Dried grains ..	.. ..	1 ,,
III.—Ground nut cake	.. ..	1 ,,
Bran ..	.. ..	1 ,,

For a cow weighing about 10 cwt. and giving about 2 gal. of milk per day, 5 lb. of either of the mixtures is a fair concentrated ration. This should be increased by 2 lb. for each extra gallon of milk. The allowance of roots should also be increased by about 10 lb. for each extra gallon. For cows above or below 10 cwt. live weight the ration should be proportionately increased or decreased.

It should be mentioned that where they are available fresh brewers' grains are the cheapest food on the market. They may be used in place of roots, 1 bush. of grains weighing 40 lb. being equivalent to about ¾ cwt. of roots, or a bushel of grains mixed with 3 lb. of bran and 7 lb. chop being about equivalent to 1 cwt. of roots.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	1¾	Wheat sharps	2	5¾
Distillers' grains (English)	1	10	Argentine maize ..	2	5¾
Distillers' grains (French)	1	10	English beans	2	8
Ground nut cake ..	1	10¼	English dun peas ..	2	8½
Maize gluten feed ..	1	11	Linseed	2	8¾
Palm-nut kernel cake ..	1	11¾	Maize meal	2	9¼
Malt culms	2	0	Egyptian cotton cake ..	2	9½
Wheat bran	2	0¾	Burmese rice meal ..	2	9½
Brewers' grains (dried) ..	2	1½	Cotton seed oil	2	9½
Decorticated cotton cake	2	1¾	English oats	2	10
Coconut cake	2	2¼	English maple peas ..	2	10½
Soya bean cake	2	2¼	Linseed oil	2	10¾
Wheat bran (broad) ..	2	3	Egyptian rice meal ..	2	11
Egyptian cotton seed ..	2	3¾	Bombay cotton cake ..	2	11¼
Wheat middlings ..	2	3¾	Argentine oats	3	1½
American maize	2	4½	Calcutta white peas ..	3	3¾
Maize germ meal	2	4½	English feeding barley ..	3	6½
English linseed cake ..	2	4¾	Feeding treacle	4	2½
Chinese beans	2	4¾			

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Palm-nut kernel cake ..	1	10½	English beans	2	8¾
Decorticated cotton cake	2	0¼	Burmese rice meal ..	2	9½
Indian linseed cake ..	2	1	Maize meal	2	10
Distillers' grains (English)	2	1	English oats	2	10¼
Coconut cake	2	1¼	Egyptian cotton cake ..	2	11¾
Argentine maize	2	4¾	Linseed	3	1½
English linseed cake ..	2	5	Bombay cotton cake ..	3	1¾
Maize germ meal ..	2	5	Linseed oil	3	4¼
Malt culms	2	5¼	Cotton seed oil	3	4¼
American maize	2	5½	Feeding treacle	4	2
Chinese beans	2	7			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	American maize.. ..	2	5¾
Ground nut cake ..	1	9¾	Cotton seed oil	2	6½
Palm-nut kernel cake ..	1	10¾	Argentine maize ..	2	6¾
Palm-nut meal (extracted)	1	11¼	English beans	2	8¼
Wheat middlings ..	1	11½	Wheat sharps	2	8½
Brewers' grains (dried) ..	2	0¼	English oats	2	9
Malt culms	2	1¾	English dun peas ..	2	9
Soya bean cake	2	2	Linseed	2	9¾
American linseed cake ..	2	2¼	Linseed oil	2	10¾
Russian linseed cake ..	2	2¼	Egyptian cotton cake ..	2	11
Wheat bran	2	2½	Calcutta white peas ..	2	11½
English linseed cake ..	2	4	Maize meal	2	11¾
Wheat bran (broad) ..	2	4¾	English feeding barley ..	3	0¼
Egyptian cotton seed ..	2	4¾	Bombay cotton cake ..	3	0¾
Maize germ meal ..	2	5	English maple peas ..	3	1

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	10½	Wheat sharps	2	6½
Wheat bran	2	0	English beans	2	7½
Palm-nut kernel cake ..	2	0¼	Wheat middlings ..	2	7¾
Distillers' grains (English)	2	0¼	English oats	2	7¾
Maize gluten feed ..	2	0½	Argentine maize ..	2	8¼
Brewers' grains (dried) ..	2	1½	Linseed	2	8½
Coconut cake	2	2¼	Argentine oats	2	9
Wheat bran (broad) ..	2	2¼	Egyptian cotton cake ..	2	11½
Soya bean cake	2	2½	Burmese rice meal ..	2	11¾
Malt culms	2	3½	Maize meal	3	0
English linseed cake ..	2	5¾	Bombay cotton cake ..	3	0¾
Maize germ meal ..	2	6¼	English feeding barley ..	3	8¾

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	3¼	Maize germ meal ..	2	5¼
Ground nut cake ..	1	10	Chinese beans	2	6
Distillers' grains (French)	1	10	Argentine maize ..	2	6¼
Palm-nut kernel cake ..	1	11¼	Wheat sharps	2	7
Palm-nut meal (extracted)	1	11¼	English beans	2	8
Maize gluten feed ..	1	11¾	English dun peas ..	2	8¾
Distillers' grains (English)	1	11¾	English oats	2	9¼
Decorticated cotton cake	2	1	Linseed	2	10
Indian linseed cake ..	2	1	Burmese rice meal ..	2	10¼
Wheat bran	2	1	Maize meal	2	10¾
Brewers' grains (dried) ..	2	1	Cotton seed oil	2	10¾
Coconut cake	2	2	Egyptian cotton cake ..	2	11
Soya bean cake	2	2¼	Egyptian rice meal ..	2	11
American linseed cake ..	2	2¼	Argentine oats	2	11¼
Russian linseed cake ..	2	2¼	English maple peas ..	2	11¾
Malt culms	2	2½	Linseed oil	3	0½
Wheat bran (broad) ..	2	3¼	Bombay cotton cake ..	3	0¾
Wheat middlings ..	2	3¾	Calcutta white peas ..	3	1½
Egyptian cotton seed ..	2	4½	English feeding barley ..	3	5¼
English linseed cake ..	2	4¾	Feeding treacle	4	2¼
American maize	2	5¼			

Where grains are used in wooden mangers the residue left in the corners is liable to ferment. This trouble is best avoided by using cement or iron mangers with rounded corners, or, as a temporary measure, the grains may be given in small tubs.

Cattle Feeding for Beef.—The cheapest ration for beef production at present prices is as follows :—

I.—100 lb. Roots.
10 lb. Straw.
3 lb. Ground nut cake.

This ration is suitable for animals put up to fatten at a live weight of about 9 cwt. As fattening proceeds, and the live

weight increases, the roots should be increased gradually up to 120 lb. and the cake to 4 lb. This ration gave excellent results last season, producing increases of over 1 stone per head per week. Ground nut cake is an excellent concentrated food for fattening cattle if used as directed above, but it should not be given in larger quantities

If roots are short and more purchased food is required the following rations will be found suitable :—

II.—50 lb. Roots.
14 lb. Straw chop.
4 lb. Bran or Dried grains.
and either 3 lb. Decorticated cotton cake.
or { 1½ lb. Ground nut cake and
1½ lb. Linseed cake.

The grains and bran should be mixed with the straw chop and damped.

III.—50 lb. Roots.
10 lb. Straw chop.
4 lb. Linseed cake.
3 lb. Palm-nut kernel cake.

All three rations are amply sufficient for 9 cwt. cattle. They should be proportionately increased for heavier cattle, and an increase will also be necessary as fattening proceeds.

Young Stock.—For *Heifers* of about 5½ cwt. live weigh growing on for breeding :—

20 lb. Roots or cabbages.
6 lb. Hay.
and either { 3 lb. Bran or Dried grains and
1½ lb. Ground nut cake.
or { 2 lb. Linseed cake and
2 lb. Palm-nut kernel cake.

For *Stores* of about 6 cwt., growing on for baby beef :—

30 lb. Roots.
9 lb. Hay.
2 lb Bran.
2 lb. Ground nut cake.

For *Calves* just weaned, live weight about 3 cwt. :—

14 lb. Roots.
4 lb. Hay.
2 lb. Linseed cake.
1 lb. Bran.

In all cases the young stock will pick out a certain amount of the leafy parts of the straw given to them for litter. If hay is scarce, it may be replaced by good oat straw at the rate of about 5 lb. of straw for 4 lb. of hay. In all cases the rations given are suitable for animals of the live weight specified. They must be increased or diminished according as the live weight varies.

Sheep or Lambs Fattening on Roots.—In addition to roots and the usual allowance of hay or chop the following mixtures of concentrated foods are suggested :—

I.—Linseed cake and Bran or Dried grains in equal proportions.
II.—Ground nut cake .. .. 1 part.
Bran or Dried grains .. .. 2 parts.

Pigs.—Pigs require food rich in starch or similar substances, and all foods of this nature are at present extremely dear. Barley meal, which is, on the whole, the best food for pigs, costs at present 3*s.* 5*d.* per food unit. The finer wheat offals are rather cheaper, costing only about 2*s.* 5*d.* per food unit. The cheapest food at the present time is probably chats or other potatoes not fit for sale.

TABLE VII.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English } " " French }	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm-nut kernel cake ..	1 : 4·5	14·1	6·1	48·9	76·7	101
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Palm-nut meal (extracted)	1 : 3·4	15·6	1·9	48·7	66·1	87
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·5	73·1	96
Wheat sharps	1 : 5·1	11·6	3·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·7	11·3	3·0	45·4	48·1	63

These should be used as follows:—A weighed quantity should be cooked, the water poured away, and the cooked potatoes mashed with an equal weight of sharps or pollards previously stirred up with enough water to make a gruel of suitable thickness. When the pigs are half fat it is good practice to stir into the gruel immediately before use 1 part of fine ground linseed cake or bean meal for every seven parts of sharps or pollards.

Cadbury Milk Recording Society.

IN the March, 1916, issue of this *Journal* were given some particulars of a sale by auction of a herd of non-pedigree dairy cows which belonged to a member of the Cadbury Milk Recording Society. The owner of this herd estimated that the possession of the milk record certificates for his cows, which are issued by the Board, and which were handed round at the sale, had the direct result of increasing the prices made by quite £200 over what would have been paid for his cows if they had not been sold with the Board's certificates. The Live Stock Officer's report on the second year of this Society's operations has been received by the Board, and it shows that notwithstanding the difficulties in regard to labour, etc., consequent on the War, steady progress has been made.

The Society, which was the first to be formed under the Board's scheme, started operations in April, 1914, with 15 members and 16 herds, comprising 414 cows. There was during the second year (1915-16) a decrease of two in the membership, and it is interesting to record that one of the two members who resigned has since rejoined, while the other was largely instrumental in the formation of the Yeovil Milk Recording Society, of which he is now a member. Notwithstanding this decrease in membership during the second year's working the number of cows controlled by the Society increased, and the Society started on its third year's operations with 21 members owning 33 herds, and a total of 643 cows.

The record of this Society is valuable as it shows the advantages—commercial and otherwise—of keeping milk records, and it points to the success of the Milk Recording Scheme when and where a society begins to realise the advantages that follow upon its adoption. In the early days of a society's operations much depends upon the manner in which the recorder carries out his duties, and this Society was fortunate in having secured a keen and energetic recorder.

During the second year of operations the average number of visits paid to each herd by the recorder was 12, the usual

interval between the visits being about 4 weeks. Samples were also taken for the purpose of testing the milk for butter fat. Three samples were taken of mixed milk of the herds, and 1,960 samples of the milk of individual cows. As a result of the evidence afforded by the records kept by the members it is noteworthy that of 558 cows recorded in the second year 160 were discarded owing to their yield being found to be deficient either in quality or quantity. By eliminating the poorer cows, and by using better bulls than formerly, the members have been able to raise the standard of the calves produced, and thus to tap a further source of profit. The demand for any surplus calves is shown by the fact that this Society reports "There has been a splendid sale of bull and heifer calves from milk record cows; forty enquiries for calves were received as the result of an advertisement in an agricultural paper."

The members of this Society have been very keen, and have made good use of the advice which is always at their disposal from the Live Stock Officer of their Province as regards the purchase of sires and other stock, the proper feeding of them, and the sale of any surplus cows or of their progeny.

The expenses of the Society for the year ended 5th April amounted to £125 9s. 8d. (the recorder's salary accounts for £109 of this sum), to which the Board contributed a grant of £50. Other income was derived from a subscription of 1*s.* per member, and three levies of 1*s.* per cow. The Society closed the year with a deficit of £12 14*s.* 10*d.*, but it may be pointed out in this connection that as they are, during the current year, controlling 33 herds (*i.e.*, 8 more than the minimum of 25 required by the Board to qualify for a £50 grant), they will be entitled, subject to their operations being carried out in accordance with the regulations, to a *pro rata* increase in the grant for the current year. The number of cows controlled by the Society at the end of the second year was 558, and it will be seen, therefore, that the net cost per cow to the Society was less than 3*s.* Three shillings per cow per year is equivalent to the value of about three gallons of milk, and from the fact that 160 cows out of the 558 recorded were weeded out, it is obvious that the information gained by keeping records alone more than repaid the members for their small expenditure of time and money.

Further, the members of this Society have obtained a practical proof in the sale previously referred to that the possession of the Board's Milk Record Certificate increases the value of a cow and her progeny. It is often argued that only breeders

of pedigree cattle are likely to reap any financial benefit from these certificates, but the member who had such a highly successful sale, owned, as is the case with the majority of the other members, non-pedigree cows of a Shorthorn type.

Motor Cultivation.

In a paper read by Mr. C. B. Fisher at the British Association Meeting at Newcastle-on-Tyne, on 7th September, 1916, the opinion was expressed that the tractor is capable of general adaptation to the various kinds of farm work. Particulars were given with regard to the working of a 20 B.H.P. Model "Universal" Tractor, made by Messrs. Saunderson and Mills, Limited. The cost was £280, with winding drum £15, and the only implement purchased especially to go with the tractor was a 3-furrow plough from Messrs. Howards, price £20 10s., the others being the ordinary farm implements with the attachments altered. The tractor was used on a farm of 850 acres, of which about 455 acres are arable, varying from light 2-horse land to stiff clay.

The tractor has *ploughed* three furrows with a consumption of 3 to 4 gal. of paraffin, 1 qt. of petrol, and 3 pt. of lubricating oil to the acre. The hardest work has usually been done with it (horses being given the lighter land) and about 5 acres per day have been ploughed.

At *threshing*, with a full-sized machine with straw trusser attached, or the engine working the elevator, the consumption has been approximately 2 gal. of paraffin an hour and 1 qt. of petrol and 3 pt. of lubricating oil a day; recently a rick of oats of 66 qr. was threshed in a day. The running costs (*i.e.*, exclusive of depreciation and interest on capital) work out at about 5*d.* per qr., *viz.*, paraffin, petrol and oil for 66 qr., £1; two men's wages, 8*s.* 6*d.*; total £1 8*s.* 6*d.* This compares with 1*s.* 7*d.* per qr. if a hired machine is used, *viz.*, charge per qr. for hire of machine, 1*s.* 6*d.*; cost and carting of 6 cwt. of coal, 1*d.* per qr. It is estimated that the saving on threshing 250 acres of corn alone would be £25, in addition to which the machine is always at hand, enabling the best use to be made of labour and opportunities.

At *hauling*, the tractor easily drew 5 tons at 5 miles an hour on the road; 18 miles were done on about 7 gal. of paraffin.

The tractor easily pulled two *self-binders*, cutting up to 30 acres in a day with a paraffin consumption of about 1 gal. per acre. It thus replaced about 12 horses at this work. The tractor cut wheat satisfactorily on 3-horse land after heavy rains.

Equally satisfactory results have been obtained from the use of the tractor for *scuffling, rolling* and *harrowing.*

Among the points of more general interest referred to by Mr. Fisher were :—

(1) The beneficial effects which would result from draining wet land with the assistance of a mole plough drawn by the tractor.

(2) The unsuitability of many American machines for haulage from the fact that they are not required for hard macadam roads in America.

(3) The advantage gained financially by running on paraffin, even if it is necessary to start on petrol.

(4) The desirability of having 3-gear speeds forward and one reverse so as to obtain the utmost economy in the various duties the tractor is called on to perform.

(5) The possibility of increasing employment by its capability of reconverting the strong wheat land to its proper purpose.

(6) The rise in wages of the agricultural labourer if he is converted into a mechanic.

(7) Finally, the need for exhaustive trials of machines under similar conditions by some such body as the Royal Agricultural Society.

Soya Bean Meal and Palm Kernel Meal.

THE Board desire to draw the attention of farmers to the fact that considerable quantities of oil-extracted soya bean meal and palm kernel meal are obtainable in this country, and may be used for feeding purposes at relatively low cost. These meals closely resemble in composition the cakes of the same name. In the case of the meals, however, the oil is extracted by chemical solvents, and in the case of the cakes by hydraulic pressure, the result being that the meals contain relatively less oil and correspondingly more albuminoids than the cakes. The meals may be used for practically the same purposes as the cakes, being introduced gradually into mixed rations up to a quantity of about 2 lb. per day for cattle. It should be remembered that soya bean meal in particular is a highly albuminous food, and should be used in relatively small quantity, along with foods rich in carbohydrates. So far, these meals have not been extensively used for feeding purposes in this country, but, in view of the relatively higher cost of most of the other feeding-stuffs, they are certainly worth a trial at the present time.* With regard to palm kernel meal, experience so far gained seems to show that along with sharps or middlings, in the proportion of 1 : 4 or 5, it is a very suitable food for pigs.

* Suspicion, however, attaches to soya bean meal extracted with

Distribution of Sittings of Eggs of Pure Breeds of Poultry to Cottagers and Small Holders, 1916-17.

WITH a view to the improvement of the poultry kept in the rural districts of England and Wales the Board of Agriculture and Fisheries have invited the co-operation of county councils in the establishment of a limited number of stations for the distribution of sittings of eggs of pure-bred fowls. The conditions on which stations will be approved for the purposes of this scheme are set out in a separate Memorandum which is printed on p. 702 and of which copies may be obtained from the Board.

Persons Eligible to Receive Eggs.—Only *boná fide* cottagers and small holders who are residents within the county in which a station is situated are eligible to receive sittings of eggs from that station. *Residents in the county of London and in the area of any city or county borough cannot be supplied with eggs under this scheme.*

A *cottager* is defined for the purposes of this scheme as a person inhabiting a cottage the rent of which does not exceed 12*s.* 6*d.* a week. A *small holder* is a person whose holding is used for agricultural purposes, and either does not exceed 50 acres in extent or the assessment of which does not exceed £50.

How to Obtain Sittings of Eggs.—Persons eligible to receive sittings of eggs should write to the Agricultural Organiser for the county in which they reside (a list of addresses may be obtained) and enquire if the Board's scheme for the distribution of sittings of eggs is being put into operation in their county, and, if so, ask to be supplied with a list of the approved station-holders. Should the Agricultural Organiser reply that the scheme has not been adopted by his local authority, the applicant will know that he is unable to obtain eggs, as the distribution from each station is restricted to the administrative area of the county in which it is situated.

The Board anticipate, however, that the scheme will be adopted by the majority of county councils in England and Wales, and it may be assumed, therefore, that applicants will usually be supplied with a list of station-holders in their county showing the name of the breed of fowl from which the station is authorised to supply sittings. Orders for sittings should be sent direct to the station-holder and the following conditions should be observed :—

(i.) The applicant must enclose a postal order for 2*s.* 6*d.* for each dozen of eggs ordered. This sum will cover the cost

of a suitable box for packing, but purchasers will be required to pay the cost of carriage.

(ii.) The applicant should state that he is a cottager or small holder, as defined above. In the event of this condition not being complied with, it will be within the discretion of the station-holder to refuse to supply the eggs.

(iii.) The applicant should give, in addition to his full name and postal address, the name of the railway station to which the eggs may be sent.

Conditions on which Eggs are Supplied.—Sittings of eggs are distributed under this scheme on the distinct understanding that they are to be used for hatching. Eggs will not be supplied before 1st January, 1917, or after 30th April, 1917. Orders will be dealt with in strict rotation, and no applicant will be permitted to obtain more than 3 doz. eggs under the provisions of this scheme. All eggs sent out from the approved stations will be stamped with a stamp provided by the Board, and infertile eggs (that is, "clear" eggs only) will be replaced if they are returned to the station, carriage paid, within 28 days of the date of the despatch of the sitting. Station-holders are entitled to refuse orders and return postal orders, after they have received as many orders as they can deal with under the scheme.

Enquiries for information as to the working of the scheme in any particular county should not be addressed to the Board, but to the local officer whose address is given in a list printed in the notice issued separately.

Suggestions as to the Precautions to be Observed for the Safety of Day-Old Chickens Received by Post or Rail.

1. PREPARATIONS should be made for the chickens before they are due to arrive. On arrival they must be kept warm, either by securing a quiet hen who will brood them, or by means either of an artificial rearer, or of the temporary substitute described below.

2. If it is decided to rear the chickens by natural means, select beforehand one, or if possible two, quiet hens which are thoroughly broody. Dust the birds with a reliable insect powder once or twice to free them from parasites. Prepare suitable nests* for them, set them on nest eggs and provide them regularly each morning with grain and water. Give two or three chickens to the hen *after dark* and carefully observe how she behaves. If she appears restless,

* See Leaflet No. 305.

jerks her head rapidly towards the nest at intervals and does not "croon" to the chickens, she should be rejected and another hen should be tried. If she croons to the chicks and appears quiet and settled, she is likely to prove satisfactory and 10 or 12 chicks may be entrusted to her.

3. If the chickens arrive in the daytime they must be kept warm until they can be given to the hen. Chickens do not require food for at least 48 hours after they are hatched, but they must have warmth.

4. *Artificial Brooders* are of various types, but they all require reasonable care and intelligent management. The lamp of the brooder—if a lamp is used— must be refilled and the wick must be trimmed regularly. Good paraffin oil should be used, and no oil should be allowed to remain on the outside of the reservoir. Whatever type of brooder is selected for use, examine it thoroughly, and remove and replace the various parts so as to become familiar with the structure of the machine. Test the brooder thoroughly before the chickens arrive and work it in accordance with the maker's directions.

5. *Other Means of Providing Heat.*—Procure a basket that will serve as a warm nest when filled with fine dry hay or grass; and, if possible, line it with a handful of downy feathers. The nest should be *just sufficiently large to hold the chickens.* Cover the top of the basket with a full-sized piece of flannel or blanket, gently pressed downwards into the hollow of the nest until it just touches the back of every chicken. Place a layer or two of soft paper in this hollow. If the weather or room be cold, place several layers of flannel and paper over the chicks. However you arrange matters place the basket with the chickens near a fire, or other steady source of heat. Then leave the birds for one hour, after which you should gently raise the nest cover to ascertain what the conditions are. If the birds are spread out, breathing quietly and show dry, fluffy coats, all is well. Cover them as before. But if they are panting, with coats discoloured with streaks of moisture—(they appear as if shrunken in size)—the nest is too warm and the covering should be reduced. The larger the flock the less the cover necessary to produce proper and safe conditions in the nest. This improvised fireless brooder should only be adopted as a temporary measure until sitting hens that *will* accept the chickens are obtained.

6. Particulars of suitable methods of feeding will be found in Leaflet No. 114 and Special Leaflet No. 54.

THE following note has been communicated to the Board by Dr. T. Milburn, Secretary of Agriculture, Lancs County Council :—

Eradication of Cranesbill from Meadows.

In some districts in East Lancashire the use of the chain harrow and roller on grass land has been allowed to lapse, and in all probability this is a contributing factor in enabling certain weeds to gain the ascendancy over every other species of plant in the field. A weed which appears to be obtaining a firm hold in some meadows is a species of *Geranium* or Cranesbill (*Geranium sylvaticum*, L.)

Advice was sought in 1914 regarding the above weed by a farmer in the Chatburn district, who had a meadow which was completely overrun with the weed. The soil is a rich, deep, free, well-drained loam lying on limestone. The farm was visited and the farmer reported that the Cranesbill was increasing very rapidly. It was noted that the only places free from the weed were a broad cart-road through the field, a belt round the field some six or eight yards from the hedge, and a fairly large patch near the gateways; it was further observed that the adjoining pastures were free from the pest. These facts suggested that the plant could not stand treading, and would not thrive in a firm soil. The cows refused to eat the Cranesbill when turned into the meadow,

The Board of Agriculture and Fisheries were consulted, but as they were unable to trace the results of any experiment designed to eradicate the weed, it was decided to carry out a trial on the field in question, and include certain measures suggested by the Board.

From the outset it was felt that different dressings of the various fertilisers would be of little value, as the field was apparently in "good heart," hence chemical treatment and "injury to the plant" were also included in the trial. It is regrettable that no plot was included to test the effect of consolidating the soil.

Plots of one-twentieth of an acre were set out and treated as follows :—

1. Untreated.
2. Scratched heavily with a fork, no harrows available.
3. Cut twice with scythe.
4. 1 cwt. sulphate of ammonia.
   4 ,, superphosphate.
   4 ,, kainit.
5. 6 cwt. kainit.
6. 5 ,, common salt.
7. Complete artificials as on Plot 4, and sprayed when 3 or 4 in. high with a 3 per cent. solution of copper sulphate.
8. Sprayed with a 3 per cent. solution of copper sulphate.

Three additional plots were put down in the following year :—

(9) Dressing of liquid manure.

(10) 6 cwt. superphosphate.

(11) 6 ,, superphosphate with wild white clover sown and well raked in with a fork.

NOTE.—The manurial dressings are "per statute acre."

As the object was to find out whether there was any reduction in the proportion of Cranesbill, as observable by inspection, the crops were not weighed. The farmer reported that the crop was much heavier where the artificials had been applied, and was inclined to the idea that (for that reason) the treatment was effective.

Members of the staff have visited the plots during the last three years, and their observations may be summarised as follows :—

1. The various manurial dressings have been ineffective.
2. Spraying with copper sulphate and dressing with liquid manure had an immediate temporary effect in 1914 and 1915, but by the time the crop was ready to cut there was no apparent difference.
3. Scraping with the fork appeared ineffective, though it tended to alter the appearance of the sward.
4. Wild white clover germinated well but has so far failed to cause any reduction in the Cranesbill.

It may, therefore, be said that the results are of a negative character. It is possible, however, that an effective way of exterminating the pest would be to pasture the field for a number of years.

Since the above trial was carried out, it is recorded that a farmer in Yorkshire has had considerable success by repeated cutting with the scythe.

Another species of Cranesbill (*Geranium pratense*, L.) is also present in some of the meadows in the Chatburn district, but it does not appear to be spreading or becoming a serious pest.

Lichen on Lawns.

THE Board have received an inquiry from a correspondent with reference to the infestation of a lawn, in a rather damp situation on a sandy sub-soil, by a plant which identification proved to be a lichen (*Peltigera canina*, Linn.)

This lichen is common on damp and shady lawns. To eradicate it, the lichen should first be removed by hand picking, and the grass afterwards watered at intervals with a solution of iron sulphate (3 lb. to 1 gal. of water). Dressings of fresh soot are also useful for keeping lichen growths in check.

Bracken as Litter.

It is necessary on most farms at the present time to eke out the supply of straw for litter and fodder, and for this reason it may be useful to reproduce a note which appeared in this *Journal* in October, 1915, p. 689.

In view of the present high cost of feeding stuffs, it is necessary that as much as possible of their manurial value should be recovered in the dung. The fact that the ordinary supplies of potash are meanwhile cut off furnishes another reason for preserving manure, especially liquid manure, with great care; liquid manure is rich in potash. In districts, therefore, where straw is scarce, or where it can be profitably fed to stock, farmers and horse-keepers should use for litter any other suitable material that may be available at a reasonable cost. Bracken or "fern" is specially worthy of attention at the present time.

Bracken possesses considerable value as litter, and in many places it may be obtained for the cost of cutting and carting. Bracken harvested while still green usually contains as much phosphoric acid as straw, and much more nitrogen, but less potash. If exposed to rain throughout the winter a considerable loss of substance is likely to result, although bracken cut in April has been found, on analysis, to have a similar composition to straw.

Bracken possesses a considerable power of absorbing ammonia and urine. To secure the full absorptive effect, however, bracken must be very thoroughly trampled upon by stock.

Dung made from bracken may be expected to be equal in chemical composition to dung made from straw. On the other hand, it takes longer to decompose in the soil, the fibrous woody stems being only slowly attacked. It, therefore, opens up the soil more, and is for that reason likely to be more useful on a heavy clay than on a light, sandy soil. Bracken should be cut and dried in autumn, but where this is impracticable it may be cut and carted during suitable weather throughout the winter months.

The Food Value of Acorns, Horse Chestnuts and Beech Mast.

ACORNS, horse chestnuts and beech mast may all be used as food for stock if fed with discrimination, though there is evidence to show that if carelessly fed the results in the case of acorns and beech mast may be serious. Relatively, however, serious accidents are so few that there is no reason for avoiding these foods in times of scarcity, and the Board feel that at the present time full use might be made of them, subject to their being unaltered by moulds or ferments, and to their being given only in small quantities in conjunction with other foodstuffs.

Owners and occupiers of land who do not themselves have

these products collected would probably gladly allow cottagers and others to gather them for their own use.

A Special Leaflet (No. 9) on the food value of acorns, horse chestnuts and beech mast was issued by the Board two years ago, and may be obtained post free on application.

NOTE.—A full account of the food value of Acorns, Horse Chestnuts and Beech Mast was given in this *Journal* in September, 1914, p. 511.

Extracted Soya Meal Poisoning.

SOYA beans, after the oil has been extracted, are made into meal or cake and used for feeding to stock. The extractor usually employed has been naphtha, but trichlorethylene had also been recently used.

Some time ago a certain number of cases of poisoning of cattle attributed to this feeding-stuff, were brought to the notice of the Board. The symptoms, which were sudden in their onset, were as follows: Discharge of blood from the nostrils, congestion of visible mucous membranes, suspension of rumination, shivering, high temperature (105°–109° F.), discoloration of dung due to blood, abdominal pain, presence of blood tumours under the skin, varying in size from a hen's egg to a child's head. The interval elapsing between the first appearance of symptoms and death in the case of 36 animals observed varied from 1 to 17 days. On post-mortem examination, hæmorrhages were found on all the mucous and serous membranes of the body. In the intestines these hæmorrhages had caused the rupture of the mucous membrane, and gave the appearance of bleeding ulcers. Experiments were therefore undertaken to ascertain whether extracted soya cake and meal had poisonous properties. Heifers, pigs and a sheep were fed on this meal, samples of which were obtained from farms on which animals were diseased; in all, experiments were made on 8 heifers, 2 pigs, 1 ewe, 3 guinea-pigs, and 1 rabbit. Some of the heifers died, but the pigs and sheep showed no symptoms of illness. The conclusions and considerations arrived at after the experiments were as follows:—

(1) The symptoms and post-mortem lesions in cases experimented upon were identical with those reported to the Board.

(2) In both cases animals were receiving other foodstuffs (some went out to grass). This discredits the possibility of the disease being due to a deficiency of vital constituents.

(3) The disease sometimes did not show itself until some days after the feeding of the extracted cake or meal had been discontinued. This points to the poison being one which takes

some time to act, and might also mean that the actual poison is manufactured inside the animal by a slow process.

(4) In no case was a sudden effect produced. A considerable amount of meal was consumed and a considerable time elapsed before signs of illness appeared. The smallest amount consumed before disease began was 172 lb. (36 days); the shortest time in which disease appeared was 29 days (201 lb.).

(5) Cattle are the only sufferers. Not all bovines are badly affected by the poison. On nine premises the percentage of visibly affected varied from 1 to 19 per cent.—an average of 10 per cent., and amongst the visibly affected the death-rate varied from 6 to 100 per cent.—average 84 per cent., so that the average death-rate over the whole was 8·4 per cent.

(6) The very high temperature (106°—109° F.) of affected animals seems to exclude ordinary poisons, but not those of the ricin class. Specific bacterial infection was excluded by test inoculations, microscopical and bacteriological examinations, and by the fact that a sterilising temperature was used in the process of manufacture. No castor seeds could be traced in the meal.

(7) From inquiry (very wide) whole soya bean is not poisonous.

(8) From inquiry amongst manufacturers there is evidence that soya extracted with naphtha does not cause poisoning, and that poisoning appeared with the use of trichlorethylene.

(9) Trichlorethylene itself is not poisonous when given in comparatively large doses to cattle—1 to 3 oz., and for a long period. It may be (*a*) that the products from trichlorethylene obtained by heat are poisonous (this is doubtful); (*b*) that the trichlorethylene in contact with the soya and heat used to drive off the former forms a poison; or (*c*) that some of the trichlorethylene was impure and contained other bodies.

(10) Extracted soya meal constitutes an excellent auxiliary foodstuff for cattle, but it is inadvisable to use trichlorethylene as the extractor.

Note.—It should be emphasised: (1) that sheep and pigs were unaffected by the soya bean meal; (2) that in the case of cattle suspicion only attaches to meal extracted with trichlorethylene; and (3) that the cases referred to occurred about four years ago, and it is understood that trichlorethylene is not now much used for extracting soya beans. Farmers might ask for a guarantee that trichlorethylene has not been employed. (See also p. 684.)

Full particulars of the experiments, symptoms and post-mortem examinations are given in an article by Sir Stewart Stockman, Chief Veterinary Officer of the Board of Agriculture, in the *Journal of Comparative Pathology and Therapeutics*, June, 1916, p. 95.

Report of Committee on Increased Prices of Commodities.

THE Interim Report of the Committee to investigate the Principal Causes of the Increased Prices of Commodities (*Cd.* 8358, *Price* 2½*d.*) deals with the rise in price of meat, milk and bacon. In relation to these commodities, the Committee conclude as follows:—

Meat: The cost of meat has increased steadily until now the price is about 5½*d.* per lb. above that of July, 1914. The increased cost of feeding-stuffs and fertilisers has contributed somewhat to this rise, as has also the increase in the wages of agricultural labourers, but the chief factor has been the decrease in the amount of frozen and chilled meat placed upon the market for consumption by the civilian population. This is largely due to the demand for meat, not only for our own armies, but for those of France and Italy. Consequently, meat prices have risen in neutral countries as well as among the belligerents. Only by an increase in insulated tonnage, seconded by rapid handling in the ports, can the imported meat supply for civilian consumption be effectually increased.

Milk: The price of milk is in obvious economic connection with the prices of meat and cheese. The increased profit from slaughtering cattle has led to a decrease in the number of dairy cows. Cheese-making has also absorbed a greater quantity of milk. This and the increased demand of makers of margarine, tinned milk and milk chocolate, together with the increased cost of production, have been the determining factors in the rise in the price of milk.

Bacon: Bacon prices have risen considerably less than those of other meat (about 46 per cent.). The rise is largely attributable to the increased cost of freightage (including dock dues, etc.), in the case of imported bacon, and to the higher price of feeding-stuffs as regards the home supplies.

RECOMMENDATIONS: The recommendations of the Committee include the following:—

(1) Speeding-up the building of merchant vessels, especially of insulated shipping.
(2) Provision of sufficient men to attend to the necessary work of loading and unloading vessels, hence obviating congestion on the docks and railways.
(3) A strengthening and stricter application of the Board's "Maintenance of Live Stock Order."
(4) A development of the Government's policy of large-scale purchases of meat.
(5) The opening up of supplies of Brazilian meat by expediting the building of refrigerating stations in that country.
(6) The institution of a meatless day per week.
(7) Further attempts by the Board to induce women to take up milking and to persuade farmers to employ them.
(8) The supply to the Board (or Board of Trade), by all wholesale milk dealers in large towns, as soon as the winter contracts are arranged, of the names and addresses of the farmers from whom they have purchased milk, and the estimated quantity and price of the milk supplied by each producer, together with similar information as to expiring contracts.
(9) The introduction of Municipal shops for the sale of milk, meat, bacon or other necessary foodstuffs, where excessive profits are believed to be made by retailers.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

FIELD CROPS.

Varieties of Oats (*N. of Scotland Agric. Coll., Leaflet No.* 51).—Seven varieties of oats, Potato, Victory, White Propsteier, Ligowo, Banner, Leader and Hamilton, were grown on a sharp loam. The Swedish varieties, Victory, White Propsteier and Ligowo, gave the best results as regards dressed grain. Leader, Potato and Hamilton gave most straw. Banner gave a good return, but was not superior to the Swedish varieties. Leader produced a great bulk of rough straw which became twisted and broken before harvest. The grain was coarse and the bushel weight light.

Six varieties, Potato, Sandy, Golden Rain, Yielder, Record and Hamilton were grown on a light loam. Record gave by far the best yield of grain, with a fair yield of straw. The largest yield of straw was given by Sandy.

Varieties of Barley (*N. of Scotland Agric. Coll., Leaflet No.* 51).—Six varieties of barley, Common, Chevalier, Hannchen, Standwell, Reg. Danish Archer, and Maltster were tested. Common barley and Hannchen gave the best return. The latter gave a slightly higher bushel weight, but has a tendency to become infected with smut. To prevent this it might be advisable to pickle the seed with a solution of copper sulphate before sowing. Chevalier gave a comparatively poor return of grain. The yield of straw was heavy but it was badly lodged, and broke down before harvest. Danish Archer and Maltster, although giving a fair return, were not equal to Common.

Varieties of Wheat (*N. of Scotland Agric. Coll., Leaflet No.* 51).—Eight varieties of wheat, Svalöf Grenadier, Garton's Victor, Sunwheat, Little Joss, Webb's New Standard Red, Svalöf Extra Squarehead, Garton's Browick and Webb's Marklane White were grown on a light loam with a gravelly subsoil. No manure was applied to the wheat, which was grown after swedes. Svalöf Grenadier gave the best result in yield of both dressed grain and straw. Garton's Victor came a close second as regards grain but gave considerably less straw. Webb's Marklane White was late in maturing, and had a very weak straw, which broke down under the weight of the grain before harvest.

Rape as a Silage Crop (*Jour. Agric. Research*, VI., 4).—Rape was successfully ensiled in glass jars, alone and in mixtures with other materials. With a few exceptions the silage was palatable to pigs. Chemical examination of the samples showed the acidity and alcohol content to be comparable in most cases to that of maize silage. A mixture of rape and a legume produced the best quality of silage.

Wheat after Linseed (*Jour. Roy. Agric. Soc.*, 1915).—Wheat after linseed gave double the crop obtained where it was grown after oats.

Influence of Magnesia on Wheat (*Jour. Roy. Agric. Soc.*, 1915).—An application of 4 tons per acre of ground magnesia (68 per cent. magnesia, 10 per cent. lime) increased the wheat crop in 1915 by 7 bush. of corn and 4½ cwt. of straw per acre, besides increasing the nitrogen content of the corn by ·17 per cent.

Wheat grown on a plot to which magnesia had been last applied three years earlier gave an increased crop of 2 bush. of corn and 1¼ cwt. of straw per acre, and the mangold crop which preceded the wheat was also superior where the magnesia had been applied.

Varieties of Potatoes (*Univ. Coll. of N. Wales, Bull. I.*, 1915).—Experiments with late potatoes were carried out at seven centres, the average weights of marketable tubers obtained per acre being as follows: President, 12 tons; King Edward, 10 tons 17 cwt.; Summit, 10 tons 9½ cwt.; Arran Chief, 9 tons 9 cwt.; Vitality, 9 tons 3 cwt.; Dalhousie, 6 tons 9 cwt. The poor crops of Dalhousie were possibly due to the fact that its growth was checked at an early stage by disease.

Four early varieties were grown at a number of centres; of these, Midlothian Early was grown at three centres, and gave the smallest crop of the four at each; it is, however, a very early variety of high quality. The remaining three varieties were all grown at five centres and gave the following average weights of marketable potatoes per acre: Epicure, 5 tons 5½ cwt.; Ninety-fold, 7 tons 2½ cwt.; Sharpe's Express, 6 tons 1 cwt. Sharpe's Express is of better quality, and more resistant to disease than the other two varieties.

Varieties of Mangolds (*Univ. Coll. of N. Wales, Bull. I.*, 1915).—The experiments were carried out in three series (one in 1914 and two in 1915). The average weights of roots per acre were: Yellow Globe (A), 43 tons 5 cwt.; Giant Orange, 41 tons 9 cwt.; Yellow Globe (B), 39 tons 15 cwt.; Red Globe, 39 tons 6 cwt.; Red Intermediate, 39 tons; Long Red, 34 tons 11 cwt.; Yellow Intermediate, 32 tons 12 cwt.; Golden Gatepost, 31 tons 17 cwt.; Golden Tankard, 29 tons 13 cwt.; and Golden Globe, 28 tons 16 cwt. The "A" seed of Yellow Globe was obtained from a different source from the "B."

The dry matter content was found to be highest with the Golden varieties, but the extra quality was not sufficient to make up for the smaller crop as compared with other varieties.

LIVESTOCK AND DAIRYING.

Milk Substitutes for Calves (*Midland Agric. and Dairy Coll.*)—The object of this experiment was to find a satisfactory and economical method of rearing calves with a minimum quantity of milk. Three lots of four calves each, when about 3 weeks old, were fed as follows:—Lot 1, separated milk and crushed oats; Lot 2, water and mixture A, consisting of 1 part by weight linseed cake (finely nutted), 1¼ parts wheat germ meal, and ¼ part dried yeast; Lot 3, water and mixture B, consisting of 1 part linseed cake (finely nutted) and 1¼ parts bean meal. The change from whole milk occupied from 2 to 3 weeks. When 14 weeks old the calves were turned into a covered yard and fed on a mixture of 1 lb. linseed cake (nutted), 1¼ lb. wheat germ meal or fourths and ¼ lb. dried yeast, with hay *ad. lib.* and some green grass or clover or cabbage. From 6 to 12 months old the daily ration during winter was 3 lb. oat straw chaff, 2 lb. pulped mangolds, ¼ lb. dried yeast, ½ lb. bran and fourths, 8 lb. cabbages or whole mangolds, 1 lb. cake (linseed up till January, and afterwards a mixture of soya bean and ground-nut cakes), and hay *ad. lib.* The progress made by the three lots of calves was quite satisfactory, and good, well-grown yearlings have been produced. The calves, though not so fat and sleek in the coats as calves fed on whole milk, were always in good growing condition, and never had the unthrifty pot-bellied appearance so common among calves fed on gruel. This was due in all probability to the foods being fed dry. Either of the mixtures A and B are satisfactory foods for feeding to young calves with water only, and are quite equal to separated milk and crushed oats, and somewhat cheaper.

Calf Feeding with Maize Meal (*Jour. Agric. and Tech. Instr. for Ireland*, April, 1916).—Experiments to ascertain whether calves could be reared as economically by feeding maize meal alone with separated milk, as by feeding an equal weight of a calf meal mixture of 1 part ground flaxseed, 2 parts oatmeal and 2 parts maize meal, were carried out at 31 centres with 242 calves. The age of the calves was 6 weeks, and the experiment lasted 121 days. The results showed an average gain in weight per calf per day of 1·51 lb. from the calf meal, and 1·49 lb. per day from the maize meal. The costs of producing 1 cwt. live-weight increase were £1 0*s*. 9*d*. and 16*s*. 5*d*. respectively. This indicates that calves may be reared as successfully on maize meal as on calf meal and at less cost.

Pig Feeding (*W. of Scot. Agric. Coll., Bull.* 75).—The primary object of these experiments was to ascertain the best method of feeding a particular ration. The experimental animals in 1914 and 1915 were 48 Large White Yorkshires, 11 weeks of age and of about 40 lb. live-weight. The experiment lasted 16 weeks, and the ration consisted of 1½ lb. (rising to 4 lb.) of meal and 6 lb. (rising to 18 lb.) of whey per pig per day.

In 1914 the meals were fed (*a*) raw and dry, (*b*) soaked in whey (this whey was additional) and fed moist, (*c*) scalded with boiling water and fed moist. The resulting average increases in live-weight per pig per week were 7 lb., 6·60 lb., and 6·60 lb.

In 1915 the (*a*) and (*c*) meals were fed as before, but (*b*) was replaced by a meal fed dry and with one-eighth part by weight replaced by fish meal. The resulting average increases in live-weight per pig per week were (*a*) 8·8 lb., (*b*) 9·5 lb., (*c*) 8·3 lb.

The following conclusions are drawn:—

(1) Where whey is available for pig-feeding, and is utilised in the proportions referred to, the meals constituting the other part of the ration should be fed raw and dry.

(2) Apart from the saving in labour, fuel and time, the pigs make better progress on the dry meals than on scalded or soaked meals; this is the case even when the meals are soaked in whey.

(3) A smaller quantity of meal suffices to produce 1 lb. of live-weight increase when the meals are fed raw and dry than if soaked or scalded, and consequently the live-weight increase is more cheaply obtained by that method.

(4) The pigs are more pleasing in general appearance when fed on dry meals than if fed on soaked or scalded meals.

(5) The ration of dry meals is greatly improved by the addition of a small quantity of fish meal, and at least one-eighth by weight should replace an equal part of the mixed meals.

Feeding of Pigs on Cooked and Raw Meals (*Jour. Agric. and Tech. Instr. for Ireland*, April, 1916).—Experiments were carried out at 60 centres to compare cooked and raw meals for pigs; 464 pigs were used. The test lasted for 102 days, both lots receiving the same quantities of food. All meals fed to one lot of pigs were either boiled or steeped in boiling water, while all meals fed to the other lot were either damped or steeped in cold water.

The results showed an average daily gain of 1·50 lb. weight with pigs fed on cooked meals, as compared with a gain of 1·57 lb. with pigs fed on raw meals, which conclusively proves that raw meals are as good as cooked meals for fattening pigs. Reports as to the quality of the

meat of the animals were received at 43 centres; 3 favoured the cooked meal lot, and 11 favoured the raw meal lot, while in 29 cases no difference could be distinguished.

Cattle Feeding (*Jour. Agric. and Tech. Instr. for Ireland*, April, 1916).—In order to ascertain whether it was profitable to feed cake and meal to cattle being fattened on second-rate pasture, experiments were carried out at 14 centres with 158 animals, averaging about 7¾ cwt. in live weight. One lot was fed with 3 lb. rising to 5 lb. per head of a mixture of 2 parts undecorticated cotton cake and 1 part maize meal, while the other lot received no cake or meal. The results showed an average daily gain over 92 days of 2·38 lb. from the cake and meal-fed cattle, as compared with 2·08 lb. for the other lot. The costs of 1 cwt. live-weight increase were £1 3*s*. 2*d*. and 15*s* 5*d*. respectively. This is taken to indicate that a direct profit from an increase in live-weight cannot be anticipated from feeding with these concentrated foods, but indirectly the practice may prove profitable if the cattle realise a higher price per cwt.

At 13 stations, with 112 animals, averaging about 9½ cwt. in live weight, cattle were divided into two lots in order to test rations containing large and small quantities of roots, and received per head per day: Lot 1, 6 stones roots with a moderate amount of concentrated foods (3 lb. and upwards) and Lot 2, 3 stones roots, with an extra allowance of 3 lb. concentrated foods. The concentrated foods used consisted of a mixture of equal parts of decorticated cotton cake, maize meal, and crushed oats. The results showed an average daily gain in weight (over 101 days) of 1·93 lb. for Lot 1, and of 2·03 lb. for Lot 2, the cost of producing 1 cwt. live-weight increase being £2 3*s*. 3*d*. and £2 5*s*. 2*d*. respectively (the turnips were charged at 8*s*. per ton). This tends to show that the two rations were approximately equal as regards fattening properties, and that an amount of roots as low as 3 stones per head per day is sufficient for successfully fattening cattle.

WEEDS AND PLANT PESTS.

Disease in Potatoes on Virgin Soil (*Jour. Agric. Research*, VI., 15).—In these experiments in Idaho, disease-free potato seed was planted on virgin soil, in some cases directly, in others after a crop of barley followed by lucerne. Various diseases appeared, the percentage of diseased tubers being much higher on the virgin land than on the land previously cropped with the barley and lucerne.

Eradication of Bracken (*Trans. High. and Agric. Soc.*, 1916).—On 10 acres of uniform bracken-stocked land various plots were set out. Plots 1 and 2 were raked clean of dead bracken and sown down with a grass seeds mixture after being fenced off with rabbit netting; Plot 3 was cut once on July 7th; Plot 4 twice, on June 7th and July 7th; Plot 5 three times, on June 7th, July 7th, and August 7th; and Plot 6 was cut whenever bracken appeared.

At the end of the growing season Plots 1 and 2 carried a dense crop of tall bracken; Plot 3 bore a thin crop about 32 in. high; Plot 4 produced a dense crop about 35 in. high; Plot 5 produced a thin crop about 16 in. high; and Plot 6 was practically bare of bracken. Apparently, therefore, it is better to cut bracken at certain definite times rather than indiscriminately, and cutting should be carried out just before it reaches its maximum height growth, late cuttings being more effective than too early ones.

During the following year no cutting operations were conducted, and (excepting Plot 6, which produced a thin crop) at the end of the growing season the plots did not differ from the control area; treatment for one year (except as regards Plot 6) had little or no effect therefore.

In the first year, spraying and dusting were tested on 12 further plots. Ferrous sulphate, copper sulphate, kainit, sulphuric acid and hydrochloric acid were tested, but the only effective material was the sulphuric acid. Four weeks after spraying with this acid a second spraying was carried out, as a fresh crop had appeared; no further bracken appeared that year. The grass was not affected and in the succeeding year came earlier and better, while the bracken appeared more slowly than on other plots.

Spraying with sulphuric acid ($2\frac{1}{2}$ and 5 per cent. solutions) has the advantage that larger areas can be treated with less expenditure of time and labour than in the case of cutting; the cost was about one-third that of cutting. Spraying is not advisable in the second year if the bracken is thin, or the grass is damaged.

POULTRY.

Egg-Laying Competition in Victoria, 1914-15, 1915-16 (*Jour. Dept. of Agric,. Victoria,* June, 1915 and June, 1916).—Several world's records were broken in the 1914–15 egg-laying competition held in Victoria under the auspices of the Department of Agriculture. The winning pen of six birds (White Leghorns) produced 1,699 eggs, or an average of 283 eggs per bird, in the twelve months; the value of the eggs from this pen at 1*s.* 2*d.* per doz. was £8 5*s.* 2*d.* The winning pen of the heavy breeds (Black Orpingtons) produced 1,562 eggs. The average number of eggs per hen laid by the 588 birds included in the competition was 207; for the light breeds (414 birds) the average was 216 eggs, and for the heavy breeds (174 birds) the average was 185 eggs.

Two feeding methods were tested—(1) wet mash, (2) dry mash. The wet mash consisted of 16 lb. bran, 4 lb. ground oats, 20 lb. pollards, 4 lb. pea meal, 4 lb. oatmeal pollards and 8 lb. minced liver. The whole was mixed together with liver soup and given warm, in a crumbly condition; about 2 oz. was given to each bird in the morning and 1 oz. at mid-day, mixed with green stuff consisting of chaffed green lucerne and silver beet. The evening meal consisted of wheat, oats, and crushed maize varied according to appetite and weather conditions; about 11 to 13 oz. was given to each pen of six birds. Cut onions were given once a week as a tonic.

The dry mash consisted of $54\frac{1}{2}$ lb. bran, $53\frac{1}{2}$ lb. wheat pollards, 14 lb. lucerne pollards, 22 lb. peameal, 11 lb. oatmeal pollards, $19\frac{1}{2}$ lb. ground oats (with portion of hulls removed), $1\frac{1}{2}$ lb. dry molasses or black sugar and (at 8 a.m.) about 3 oz. of cooked minced liver to each pen. One ounce of salt was allowed to 100 birds, and was mixed with the liver. The quantity of dry mash used per day per pen of 6 birds (light breeds) was 12 oz. including minced liver. Fresh cut lucerne and silver beet were fed liberally at mid-day. More water was consumed by the dry mash fed birds. The quantity of grain used per day with the dry mash was 11 to 13 oz. per pen, and was fed about 4.30 p.m.

The feeding results were as follows:—*Light breeds:* Wet mash, 219 eggs per bird; dry mash, 210 eggs per bird (the winning pen was

fed on dry mash). *Heavy breeds*: Wet mash, 194 eggs per bird; dry mash, 169 eggs per bird. The results from the wet mash were unduly favourable in comparison as the competitors placed their best pens in this section. The dry mash feeding led to a saving in labour, and the hens so fed were hardier and tighter in the feather, and handled better.

In the four months' winter test the winning pen of light breeds produced 565 eggs, and of heavy breeds 502 eggs.

In the 1915-16 competition the wet and dry mash methods of feeding were again adopted. The wet mash was composed as in 1914-15. The dry mash used was 20 lb. bran, 48 lb. wheat pollards, 33 lb. oatmeal pollards, 16 lb. peameal, and 10 lb. ground oats (portion of hulls removed). To this was added 2 lb. of black or brown sugar. The whole was well mixed and placed in an automatic hopper, to which the birds had access during the day. Animal food, generally consisting of boiled liver, at the rate of 1 oz. to each bird, was given three or four times a week. Green lucerne, silver beet or clover, was chaffed and fed at mid-day. The evening meal consisted of wheat and oats, and during cold or rough weather maize was added. The winning pen of light breeds (White Leghorns) produced 1,661 eggs, an average of 277 per bird. The value of the eggs from this pen at 1*s*. 7*d*. per doz. was £10 19*s*. 7*d*. The winning pen of the heavy breeds (Black Orpingtons) produced 1,507 eggs. The average number of eggs per hen laid by the 570 birds in the whole competition was 219½. The feeding results were—*Light breeds*, wet mash, 226 eggs per bird; dry mash, 220½ eggs per bird. The winning pen were fed on wet mash. *Heavy breeds*, wet mash, 200½ eggs per bird.

OFFICIAL NOTICES AND CIRCULARS.

London Thoroughbred Stallion Show, 1917.

THE President of the Board of Agriculture and Fisheries gives notice that a Show of Thoroughbred Stallions will be held in conjunction with the Hunters' Improvement Society at the Royal Agricultural Hall, Islington, on 27th and 28th February and 1st March, 1917, and that sixty King's Premiums (including twelve Super-Premiums) will be offered for award by the Board on the same conditions as obtained at the Show held in March last. Full particulars of these Premiums will be issued in due course.

In addition to the King's Premiums, the Board will be prepared to consider recommendations from their County Light Horsebreeding Committees for the award of, approximately, forty Board's Premiums.

Agriculture and Recruiting.

THE following Circular Letter, dated 5th October, 1916, has been addressed by the Board to the Secretaries of the War Agricultural Committees and to the Board's representatives before the Appeal and Local Tribunals. The attention of farmers was further called to this question by the issue to the Press on the same date of a notice containing various extracts from the letter:—

IMPORTANT.

SIR,—1. I am directed by the President of the Board of Agriculture and Fisheries to call your attention to the following letter which has

been issued by the Army Council to General Officers Commanding-in-Chief, Districts, and Officers Commanding Recruiting Areas :—

"I am commanded by the Army Council to inform you that in order to maintain the production of food supplies, to allow of the autumn cultivation, and generally to review the agricultural situation, it has been agreed that, subject to any decision of the Man-Power Board, and subject to any revision which developments of the military situation, and further information in regard to the agricultural situation, may demand, no more men from among those now employed in agriculture will, till 1st January, 1917, and, in the case of men whose whole time employment on a holding is necessary for maintaining milk production, till 1st April, 1917, be called to the Colours, except in return for men released from the Colours for work at agriculture.

"Prior to these dates, however, so far as is feasible, direct substitution of men not fit for general service now with the Colours will be made for men fit for service now in civil life, but it is recognised that cases will occur where it is more in the national interest to call up a man now employed in agriculture from one place, and to send from the Colours a man not fit for General Service to work at agriculture in another. The procedure to be followed in carrying out this substitution will be laid down in a subsequent circular letter.

"To this general agreement the cases of certain men who have been refused exemption by Tribunals, but who, at the urgent request of the President of the Board of Agriculture and Fisheries, have been allowed to remain for a further stated period in civil life for agricultural work, will be treated as exceptions, and their retention in civil employment should be considered by local Military Authorities together with the representative of the Board of Agriculture on the County Appeal Tribunal.

"The President of the Board of Agriculture and Fisheries will instruct his representatives throughout the country to co-operate in every possible way with Recruiting Officers in securing men fit for general service under this arrangement.

"Steps should be taken to expedite the hearing of all applications for exemption lodged by men employed in agriculture, and due regard should be paid by Military Representatives in dealing with these cases to the fact that these men will not, subject to possible modification as indicated in the first paragraph and irrespective of the decision given by the Tribunals, be called up prior to 1st January, 1917, or 1st April, 1917, as the case may be. In dealing with these cases before Tribunals, Military Representatives should pay particular attention to the official List of Certified Occupations which contains the classes or bodies of men engaged in agriculture whose work has been certified, after consultation with the Army Council, as being of national importance, and to the scale of labour agreed upon between the Army Council and the Board of Agriculture and Fisheries as desirable to retain on farms. This scale is :—

"One skilled able-bodied man or lad (wherever possible not of military age) for each of the following :—

- each team of horses required to cultivate the land ;
- every 20 cows in milk, when the assistance of women or boys is available ;
- every 50 head of stall or yard stock, when auxiliary feeding is resorted to and the assistance of women or boys is available ;
- every 200 sheep, exclusive of lambs, grazed on enclosed land ;
- every 800 sheep running on mountain or hill pasturage.

"It is obvious that this scale cannot be undeviatingly followed, owing to the variety of methods under which agriculture is practised in different parts of the country, nor does it embrace all descriptions of men employed on the land; it is circulated merely with the intention of affording guidance as to the number of certain classes of men who are required under present conditions to preserve the farming industry."

2. The foregoing paragraphs apply to all persons engaged in agriculture, including those men whose whole time employment on a holding is necessary for maintaining milk production. The War Office has decided, subject to any decision of the Man-Power Distribution Board, that in order to keep up the supply of milk and as far as possible to prevent its rise in price, the existing labour scale for such men will be maintained until the 31st March, 1917.

3. I am desired by the President of the Board of Agriculture and Fisheries to point out that in each of these cases there is a definite terminal point. Labour on the ordinary arable holding will be preserved, so far as the War Office can ensure it, until the end of this year, in order to permit the maximum of autumn cultivation. Before the new year steps will have been taken by the War Office to obtain a census of men of military age still engaged in farming who are in excess of the labour scale, and who, therefore, can be properly recruited for the Army. It must be understood, however, that no guarantee can be given that the scale itself will not require to be revised.

4. The Military Authorities have strongly impressed upon the Department that Army requirements necessitate this power of revision during next January as regards ordinary farming, and during next April as regards dairy-farming.

5. The President of the Board accordingly thinks it his duty to urge in the clearest possible manner that farmers should strain every nerve to prepare for changes which may become necessary during January and April, 1917, and to do their very utmost to further a scheme, which has been framed in the national interest, with a view to enable the land to be cultivated and the head of stock maintained, while releasing men who are fit for General Service. A period of respite is afforded during which every effort should be made to prepare for replacing the men who may be lost later on; no available alternative should be neglected, either as regards women or elder men. Moreover, in view of the difficulties which cannot fail to increase as the War is prolonged, farmers must use every agency of co-operation to mitigate the difficulties by which they will be met.

6. The new Man-Power Board will take these questions into review, and the War Office and the Board of Agriculture will have to state their case before this court of enquiry. The facts disclosed by the investigation as to where men of military age are available will be submitted to the Man-Power Board, who have power to decide what modification of arrangements is required to meet any situation which may arise.

7. The maintenance of our food supplies remains an important factor in the successful prosecution of the War, and farmers will continue to render good service to the State by facing their acknowledged difficulties with determination and courage.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

Scheme for the Distribution of Sittings of Eggs of Pure Breeds of Poultry to Cottagers and Small Holders* 1916-17.

WITH a view to improve the class of poultry kept in the rural districts of England and Wales, the Board of Agriculture and Fisheries invite the co-operation of county councils in the establishment of a limited number of stations for the distribution of sittings of eggs of pure-bred fowls.

Conditions.— Approved Station-holders under the Scheme must comply with the following conditions:—

1. Each Station-holder will be required to provide approved stock consisting of not less than 24 pure-bred hens or pullets and one pure-bred cock or cockerel for every twelve hens or pullets; if required by the Board he must dispose of any other birds on the holding and undertake not to introduce any poultry other than the approved stock without the Agricultural Organiser's permission. Save in exceptional circumstances only one breed of fowls should be maintained.

2. The male birds used at the station must be replaced each year by males whose breeding and stamina are likely to secure and maintain vigour and fecundity in the offspring.

3. One-third of the hens must be replaced each year by well-matured pullets.

4. The birds must be suitably housed and fed, and must be divided into small flocks for breeding purposes; they must be provided with grass runs, allowing, in cases where the runs are enclosed, not less than 20 square yards per bird.

5. The Station-holder will be required to supply sittings of 12 eggs to cottagers* and small holders* resident in the county from the 1st January to the 30th April at 2*s.* 6*d.* per dozen, including the provision of a suitable box for packing. When it is possible to do so eggs should be sent by rail. *Carriage on the eggs must be paid by the purchaser.*

6. All eggs sent out from the station must be stamped with a stamp provided by the Board.

7. Orders received for eggs must be executed in rotation. Infertile, *i.e.*, "clear" eggs only will be replaced if they are returned carriage paid within 28 days of the date of the dispatch of the sitting.

8. The Station-holder will be required to keep an accurate record of the number of eggs laid during the season, and to record the name and address of each applicant to whom sittings are supplied, the date on which the order is received and that on which the eggs are dispatched. A Record Book will be supplied for this purpose which must be submitted to the Board through the County Organiser at the close of the season.

9. The Station-holder must permit officers of the Board or of the Local Authority to visit the station at any time, to inspect the stock, the method of management, and the Record Book.

10. Provided that *at least* 70† sittings of eggs are distributed to

* For the purposes of this Scheme the terms "cottager" and "small holder" are defined thus: A cottager is a person inhabiting a cottage the rent of which does not exceed 12*s.* 6*d.* a week. A small holder is a person whose holding is used for agricultural purposes and either does not exceed 50 acres in extent or the assessment of which does not exceed £50.

† In calculating the number of sittings eligible to rank in the 70, no credit will be given for more than three dozen eggs supplied to any one applicant, or for eggs distributed to applicants other than cottagers and small holders as defined in paragraph 5.

eligible applicants during the period from the 1st January to the 30th April, the Station-holder will receive a subsidy of £5 when the Board are satisfied that the conditions of the Scheme have been fulfilled. If a smaller number than 70 sittings of eggs is distributed the subsidy will be reduced proportionately, but in no case will the subsidy paid to any one station exceed £5.

11. In all matters of dispute the decision of the Board shall be final.

Applications from those who are willing to establish and maintain such stations should be made to the Agricultural Organiser for the county on a form which can be obtained from the Board. Preference will be given to applicants who are situated in the vicinity of groups of small holdings and who are engaged in agriculture.

Notice to Farmers as to the Purchase of "Nut" Cakes and Meals.

LORD CRAWFORD desires to draw the attention of farmers to the importance of ascertaining, when purchasing nut cake or nut meal, the kind of nut from which the cake or meal is made.

Formerly, earth-nut or ground-nut (*Arachis hypogea*) cake or meal was the principal cake or meal made from nuts, and used as food for cattle, and the terms "nut cake" and "nut meal" were generally understood as applying to this nut. Recently, however, coconut and palm kernel residues have come into common use. Since the outbreak of War other nuts have been introduced, and as these new materials become available for feeding live stock nut-cakes and nut-meals of several kinds are likely to be found on the market, which may be expected to vary considerably in their composition, character and uses. The statement of percentages of oil and albuminoids alone would thus not be a sufficient indication of the nature or respective properties of these feeding materials.

It appears to Lord Crawford, therefore, that the time has come when the descriptions "nut cake" and "nut meal" should not be sufficient in themselves, and, in order to avoid any confusion or misunderstanding as to the nature of the article purchased, he recommends farmers to insist on having all such cakes and meals described on the invoice by a name clearly marking their origin.

Memorandum on the Use of Glucose for Jam and Fruit Preserving.

THE following Memorandum, dated August, 1916, has been issued by the Board :—The Board of Agriculture and Fisheries desire to draw attention to the importance of making a strong endeavour to secure the whole of the plum crop, which promises to be large in most parts of England. Pershore egg plums and Victorias are likely to be plentiful, and unless an effort is made to take advantage of this abundance there is a danger that much fruit will be wasted, and there will be a deficiency of preserves during the winter, as it is improbable that the normal supplies of foreign fruit will be imported. Many private persons will, no doubt, arrange to bottle considerable quantities of plums as was done in 1914 and 1915, but it is certain that the greater part of the crop can only be utilised by the extensive manufacture of jam.

Owing to various circumstances connected with the War the supplies of sugar available for use by the public at large are only three-quarters of what they were in 1915, and though arrangements have been made whereby commercial jam makers, who cater for the residents in towns, can get their normal supplies on certain conditions, it is not possible to secure this advantage for private families who wish to preserve their own home-grown fruit. Such persons cannot at the best obtain more than three-quarters of the amount they obtained last year for all purposes.

In order to meet this deficiency the Board urge all those who have been in the habit of making home-made jam, whether from their own fruit or from fruit bought in the market, to save as much ordinary sugar as they can from their household supplies and to make up the remainder with the sugar known as Glucose, which is at the present time obtainable in considerable quantities in England. Glucose, which is sold under the name of Corn Syrup, is a preparation made in England, and also imported from America, and is extensively used in the manufacture of confectionery and sweets, especially in acid drops and toffee. Corn Syrup can satisfactorily be used in the manufacture of home-made jam if the following precautions are observed :—

1. Not more than one part of Corn Syrup should be added to two of sugar, *i.e.*, the syrup should be 33 per cent. of the preservative, and the weight of the sugar and syrup should be approximately equal to the weight of the fruit used. (The correct proportion varies slightly with the kind of fruit used.)
2. The jam should be boiled till it gets the right consistency. The usual test for this is to dip a knife into the boiling jam and see if the jam will hang from the edge in a drop. Jam which contains more than 35 per cent. of water will not keep.
3. The jam should be covered with waxed paper, or a thin sheet of paper dipped in some spirit such as whisky, to prevent the introduction of mould spores, and then tied down tightly with another sheet of paper.

Corn Syrup contains about 20 per cent. of water, and is not as sweet as sugar. This is not a disadvantage to those who like to retain the full flavour of the fruit in their jam, but those who prefer a very sweet jam should use a smaller proportion of the syrup. It also makes jam "set" better than sugar and prevents recrystallisation, a common fault in home-made jams.

Although Glucose is prescribed as a food for invalids, and is used to a large extent in confectionery, it has not come into common use in domestic cookery. With the object of popularising its use at the present crisis, therefore, the Board have been in communication with the principal manufacturers and importers, and have ascertained that there are considerable stocks of Corn Syrup in the country. The wholesale price is at present less than two-thirds of the wholesale price of sugar, and Corn Syrup can be obtained in 6-cwt. barrels, which should permit it to be sold retail at not more than fourpence-halfpenny a pound. It can be obtained from some manufacturers in 14-lb. tins at about that rate, and from others in 1-cwt. kegs. The Board will send a list of the principal firms to any applicant who wishes to make home-made jam in the manner recommended above.

AN Order of the Army Council, dated 14th September, relative to the lifting of hay and straw in Great Britain, provides that—

Lifting of Hay and Straw in Great Britain.

1. Applications (applying to hay or wheat or oat straw of the 1915 or earlier crops) for the sale or purchase or removal for the needs of private consumers will, as a rule, only be entertained for such amounts as appear to the person to whom the application is made, from a declaration to be furnished by the applicant, to be necessary either for consumption by the stock in the applicant's possession or control or to be equal to the average quantity dealt in, sold, or consumed by the applicant during the twelve calendar months preceding the date of this Order, and if it appears from the declaration accompanying an application to purchase that the applicant has not purchased or removed or applied for the purchase or removal of hay or straw from any other source covering the same service.

2. Applications to enable hay or wheat or oat straw to be sold to private consumers or dealers will only be granted in respect of qualities and quantities of hay or straw which, after inspection by an officer of the Forage Department or authorised member of a County or Central Committee, or in Scotland of the Forage Reference Committee, are found not to be required for Army use.

3. Farmers and stock-breeders are authorised to use the normal quantity of hay or oat or wheat straw in their possession for consumption by stock in their possession or control.

4. Applications for sale under this Order must be made in writing to the district purchasing officer of the district or county in which the hay or straw affected is standing.

5. Applications for purchase for local consumption by the applicant's own stock or stock in his possession or control will be made to the district purchasing officer of the district or county in which the forage stands. Applications to purchase for the purpose of re-sale or applications to purchase direct from the producer by railway companies, mine owners, corporations, companies or other bodies, will be made in England and Wales to the Administrative Member, Forage Committee, 64, Whitehall Court, London, S.W., and in Scotland to the Area Administrative Officer, 7, West George Street, Glasgow.

6. All applications must be in writing and must contain a declaration either that the forage required is necessary for consumption by stock in the applicant's possession or control or is equal to the quantity dealt in, sold or consumed by the applicant during the twelve calendar months preceding the date of this Order; it must appear from the declaration that the applicant has not purchased or removed or applied for the purchase or removal of hay or straw from any other source covering the same service.

All licences or authorities issued under the Order will be issued subject to the restrictions and conditions contained in such licences or authorities, and any departure from these conditions or other acts in contravention of the provisions of this Order will be an offence under the Defence of the Realm Regulations and render the offender liable to the penalties attaching thereto.

Detailed instructions regarding the necessary procedure to be adopted by all desiring to sell, purchase or remove hay or straw under this Order can be obtained on application to the Secretary, Forage Committee

64, Whitehall Court, London, S.W., or in Scotland to the Area Administrative Officer, 7, West George Street, Glasgow.

Wool of the 1916 Clip.

IN the case of British wool general permission is given to buy, sell, or deal in (1) raw sheep-skins, (2) skin wool pulled prior to 8th June, 1916, and (3) wool pulled from the skins of sheep or lambs before 1st October, 1916, except such wool as shall have been pulled prior to that date but shall still be in the hands of fellmongers unsold on that date. (*Board af Trade Journal*, 21st September, 1916.)

Importation of Fodder into Switzerland.

A DECREE of the Swiss Federal Council, dated 11th August, provides that, as from the 15th August, the importation into Switzerland of fodder products of all kinds (other than those of which the importation is reserved to the State) may only be effected after permission has been obtained from the Swiss Department of Public Economy (Agricultural Division). (*Board of Trade Journal*, 21st September, 1916.)

Importation of Poultry Appliances.

The Board of Agriculture and Fisheries have been informed by the Board of Trade that licences will be freely granted for the importation of incubators and parts thereof, on receipt of applications giving the necessary shipping particulars.

Agricultural Statistics, 1916.

THE usual Statement issued by the Board of Agriculture and Fisheries, giving the area under certain crops and the number of live stock in each county of England and Wales, will not be published this year. Pending the issue of the detailed returns, the Board will be willing to supply the figures for the chief crops in any particular county, on application.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Sheep in New Zealand.—Sheep of every breed have been introduced into New Zealand and, after trial, those remaining in general use are the Merino, Romney Marsh, Lincoln, English Leicester, Border Leicester, Southdown, Shropshire and Corriedale.

The Merino is the basis of the flocks, but is very much less in number than formerly, amounting to only 9 per cent. of the total sheep in the country. There are many types, the favourite being a sheep producing a strong combing-wool for which there is a great demand.

The Romney, owing to its eminent vigour of constitution is the dominating sheep of New Zealand. It is of sturdy form and crosses well with other breeds. More attention has been given to the New Zealand Romneys than to those in Kent as regards the production of wool, and it is claimed that, while the sheep retain their form and constitution, the fleece is heavier, evener and of better quality. A stud flock is reported of which the ewes clipped 21 lb., hoggets 22 lb., and rams 28 lb. As a sheep for the butcher the Romney is also esteemed.

The Lincoln, which provides the greatest weight of meat and wool, still holds prominence both as a pure-bred and for crossing purposes.

It is the sheep of the heaviest and richest districts of New Zealand, and requires better feeding than some other sheep, but responds generously to liberal treatment. The Lincoln has been selected as the most suitable sire for developing the Corriedale (except in the case of one flock of the latter).

The English Leicester of New Zealand is a different type of sheep from that of England. It is tall and large, but it is doubtful whether the wool is as fine, or if it is even of a true Leicester type.

The Border Leicester is in great favour amongst the farmers of Scottish descent in the southern part of the South Island. It is very hardy, and is in favour with the butcher.

The Southdown and *Shropshire* are used entirely for the production of cross-bred lambs for refrigeration. The Southdown cross-bred matures early. The Shropshire does not fatten so quickly, and when fat is heavier than is desired for refrigeration.

The Corriedale is the result of crossing Merino ewes with Lincoln rams (in the case of one flock the cross was with an English Leicester ram). The progeny have then been carefully selected and inbred. There are now twenty-two registered stud flocks of pure Corriedale sheep. A sheep was wanted to replace the Merino on the more fertile and better-grassed hills, and for the heavier soils of the plains. The sheep had to combine the best characteristics of the wool of the Merino with a form between an English Leicester and a Down—a sheep for wool and meat.—(*New Zealand Journal of Agriculture*, Vol. xii, 1916, No. 4.)

Estimates of the Russian Ministry of Agriculture and Land Organisation, 1916.—The estimates for 1916 show, owing to the War, a reduction on the Budget for 1915 of £497,500. The following table gives the estimates for 1916, compared with the assignments for 1915, and the average expenditure for the five years 1910-1914.

	Average Expenditure for 5 years 1910-1914.	Assignments. 1915.	Estimates. 1916.
General Expenditure—	£	£	£
General expenditure on administration	2,016,000	2,638,000	2,649,000
Educational Establishments	462,000	680,000	730,000
Land Organisation and agriculture	3,666,500	4,397,000	4,311,000
Fireproof building	251,500	634,000	615,500
Colonisation	2,894,000	2,600,000	2,256,000
Development and encouragement of cottage industries	139,500	254,000	254,000
Building and repairs	386,500	368,000	271,500
Temporary annuities	81,000	72,000	70,000
Operations of the Ministry—			
Organisation and valuation of various sources of income leased to private persons	73,500	87,000	124,000
Drainage of bogs, irrigation, peat cutting	614,500	988,000	976,000
Forestry	659,500	813,500	875,000
Health resorts and villas	8,000	4,000	10,000
Zemstvo and gmin rates and taxes	1,233,500	1,638,000	1,534,000
	12,486,000	15,173,500	14,676,000
Other expenditure	13,500	—	—
Total	12,499,500	15,173,500	14,676,000

The expenditure on education shows an increase of £50,000, owing to the greater assignments made principally for the maintenance of higher educational establishments to the amount of £18,500, and £21,000 for the maintenance of agricultural homes for the children of soldiers disabled or killed in the War.

New assignments are included for expenditure on land organisation and industries, *viz.*, general measures for the development of various branches of agricultural industry, £38,000; land survey, £37,000; maintenance and travelling expenses of specialists and instructors, £21,500; measures for encouraging afforestation, £16,000; staff for completing land organisation in Transcaucasia, £15,000; development and improvement of the co-operative sale and manufacture of agricultural produce, £10,500; and for scientific, experimental and model agricultural establishments, £9,500. Reductions have, however, been made under various headings as follows: agronomical assistance in districts under land organisation, £79,500; loans for agricultural improvements, £63,500; subsidies for land organisation, £42,000; agronomical measures in colonisation districts, £40,500; and subsidies for the development of various agricultural industries, £6,500. The total reduction in the expenditure on land organisation and agricultural industries amounts to £86,000.

The assignments for the organisation of forests and forestry operations show an increase of £61,500, which includes £53,000 for lumbering operations and £8,500 for the organisation of forests.

The amount allotted for the organisation and valuation of various sources of revenue leased to private persons is increased by £37,000, principally in consequence of the inclusion of a new assignment of £31,500 for the reorganisation of State lands in European Russia for the use of peasants who are short of land.

Administration of Studs.—The estimates for 1916, as compared with the assignments for 1915, and the actual average expenditure for the five years 1910-1914, are as follows:—

	Average Expenditure for 5 years 1910-1914.	Assignments. 1915.	Estimates. 1916.
	£	£	£
Central Institutions and general expenses of management..	18,200	25,500	24,800
Building and repairs ..	15,100	10,600	10,600
Encouragement of horse-breeding	5,200	39,700	23,800
Pensions from the State ..	1,800	2,600	2,100
Working Expenses	246,000	327,600	341,400
Total	286,300	406,000	402,700

The increase in working expenses is due to the high cost of forage, fuel and labour. (*Russian Section No. 23 to the "Times."*)

Settlement of Discharged Soldiers on the Land in New Zealand.—In New Zealand the problem of assisting the discharged soldier over the period of transition from military to civil life has been attacked with commendable promptness and thoroughness. At the outset, owing to the novelty of the work and the necessity for improvising the entire machinery, many difficulties had to be faced. The Discharged Soldiers' Information Department, the Department of State specially formed to deal with the matter, has, however, surmounted most of these difficulties and the work is now organised on a satisfactory basis.

According to the first Report of the Department, which was issued in May, the procedure adopted is, briefly, as follows :—The names, addresses, and other general particulars of returning soldiers are collected before the transports reach the landing port and are registered on cards. The cards are then sorted into the various districts and a confidential schedule is sent to a local committee. When the soldier is eventually discharged from military service he is interviewed by an officer of the Department who reports any particulars which are likely to be of use in finding him employment. With the assistance of the local committee a determined effort is then made to secure employment for those who require it.

The employment of soldiers on the land naturally forms an important part of the work of the Department. To meet the case of soldiers who have had no experience in farming, arrangements have been made with the Department of Agriculture to undertake the training of a limited number of men at the various State farms in general farming, dairying, fruit-farming, poultry, bee-keeping, etc. It was thought that partially disabled men in receipt of pensions might reasonably be expected to desire to take up small sections under the land settlement scheme for the purpose of poultry-raising and other light branches of farm work, and that in these circumstances a course of practical instruction would often save loss of time and money and consequent discouragement. Up to the present the opportunities afforded have not been taken advantage of, the men, almost without exception, desiring employment of an immediately remunerative character.

State assistance to New Zealand soldiers wishing to settle on the land, however, is by no means confined to courses of instruction. By an Act passed in October, 1915, and entitled the Discharged Soldiers' Settlement Act, 1915, a discharged soldier is given a number of advantages. Under this Act land may be taken up in two ways. Crown or settlement land may be set apart for selection *only* by discharged soldiers, or it may be disposed of to them under special conditions. In either case the Department of Lands is empowered to remit—wholly or in part, and for such periods as it thinks fit—any rent payable by a discharged soldier, or may postpone the date for the payment of the rent. When held under special conditions the soldier may receive financial assistance to enable him to bring his farm into such a state that he can make a living from it.

Land may be disposed of to discharged soldiers either by way of sale or lease. When sold, the price is fixed by the Land Board. If disposed of on terms of deferred payment, the purchaser has to pay a deposit of 5 per cent. of the purchase money, the balance being paid in equal annual instalments with interest at 5 per cent. When leased, the term may be up to 66 years with a perpetual right of renewal for further successive terms. The rent will be determined by the Board and is not in any case to be more than 4½ per cent. of the capital value of the land. The lessee may at any time during the continuance of lease acquire the fee simple of the land.

Under section 6 the Minister of Lands may assist an applicant in the clearing, fencing and general improvement of the land, erection of buildings, purchase of implements, stock, seed, trees and any other things which may be deemed necessary for the successful occupation of the land. The rate of interest is to be fixed by the Minister, but in cases of hardship he has power to dispense wholly or in part with the

payment of interest. The total of the advances made to one person is not to exceed £500. No land leased or sold to a discharged soldier under the Act can be transferred until the expiry of ten years from the date of the sale or the commencement of the lease.

According to the first Report on the working of the Act 500,000 acres of land have been provisionally set apart for discharged soldiers. Of this area 67,855 acres have formally been proclaimed under the Act. It has been decided to cut up some blocks of land into suitable sections and, before finally settling soldiers on them, to effect such improvements as will enable selectors to make a living off their sections. As far as possible soldiers will be employed in effecting these improvements. For fruit farming it has been decided to plant areas in fruit trees, particularly apples.

British Columbian Department of Agriculture.—By an Act of the Legislative Assembly of British Columbia, dated 31st May, 1916, a Department of Agriculture has been instituted for that Province under the direction of the Minister of Agriculture. This department will have the administration of laws relating to agriculture and horticulture in all their branches, and will have the supervision of all model and experimental farms, and all agricultural, horticultural, live stock, poultry and dairying associations and institutes receiving Government aid, and all advisory boards connected therewith. The books and accounts of the above-mentioned societies will be open to inspection by the department, and the production of documents may be enforced. Information on matters of agricultural, horticultural and pastoral interest will be collected, tabulated and published from time to time. A report on the work of the department will be presented to the Legislative Assembly annually.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for September, 1916, contains estimates of the production of cereal crops in the Northern Hemisphere. The countries for which it is possible to give estimates are as follows: In *Europe*—Spain, England and Wales, Ireland, Italy, Switzerland; in *America*—Canada, United States; in *Asia*—British India, Japan; in *Africa*—Tunis.

Wheat.—The total production in the above-mentioned countries is estimated at 190,700,000 qr. in 1916, against 273,216,000 qr. in 1915, a decrease of 30·2 per cent., while the area sown was smaller by 12·6 per cent.

Rye.—In the specified countries, excluding England and Wales, British India, Japan and Tunis, the production is placed at 9,704,000 qr. this year, against 9,835,000 qr. in the previous year, a decrease of 1·3 per cent., the area sown being less by 6·2 per cent.

Barley.—The total production in the above-named countries, exclusive of British India, is estimated to amount to 57,173,000 qr. in 1916, or a decrease of 11·9 per cent. as compared with 1915, when it amounted to 64,868,000 qr., but the area sown was larger by 2·7 per cent.

Oats.—For the specified countries, excluding British India and Japan, the production is estimated to total 187,770,000 qr. this year, against 240,027,000 qr. last year, a decrease of 21·8 per acre, while the area sown was smaller by 1·7 per cent.

Maize.—The production in the United States is placed at 334,270,000 qr. this year, or a decrease of 6·2 per cent. compared with last year, when the yield was 356,259,000 qr., but the area sown showed a slight increase, amounting to 0·3 per cent.

France.—An official report estimates the condition on 1st September of maize at 66 (68 last year), and of potatoes at 58 (53 last year). (80=good, 60=fairly good, 50=passable). (*London, Grain, Seed and Oil Reporter*, 18th September.)

Rumania.—An estimate published by the Rumanian Ministry of Agriculture gives the production of wheat this season as 9,400,000 qr.; barley, 3,630,000 qr.; and oats 3,400,000 qr. (*H.M. Consul General Galatz.*)

Canada.—According to the results of an inquiry made by the Census and Statistics Office, the stocks of grain remaining in farmers' hands on 31st August in Manitoba, Saskatchewan and Alberta were as follows: wheat, 11,997,500 bush.; barley, 1,779,430 bush.; and oats, 39,584,300 bush. (*High Commissioner's Report.*)

United States.—The Department of Agriculture, reporting on crop conditions on 1st October, states that the total production of winter wheat is estimated at 455,000,000 bush. as compared with a yield of 655,045,000 bush. last year; spring wheat at 156,000,000 bush. against 356,460,000 bush.; maize at 2,718,000,000 bush. against 3,054,000,000 bush.; oats at 1,229,000,000 bush. against 1,540,362,000 bush.; barley at 184,000,000 bush. against 237,000,000 bush.; and linseed at 15,411,000 bush. against 13,845,000 bush. (*Broomhall's Corn Trade News*, 10th October.)

Live Stock in Germany.—The final estimates from the census of the 1st December, 1915, give the number of horses (exclusive of the army) as 3,341,627 against 3,435,283 on the 1st December, 1914, a decrease of 2·7 per cent.; cattle, 20,316,948 against 21,828,783, a decrease of 6·9 per cent.; sheep and lambs, 5,073,478 against 5,471,468, a decrease of 7·3 per cent.; pigs, 17,287,211 against 25,341,272, a decrease of 31·8 per cent.; goats, 3,438,296 against 3,538,414, a decrease of 2·8 per cent. (*Bulletin of Agricultural and Commercial Statistics*, September, 1916.)

Agricultural Conditions in England and Wales on 1st October.

THE reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales, state that September was generally favourable to agriculture throughout the country. The first few days were rainy, but the subsequent dry weather, if cold and dull, enabled good progress to be made with the corn harvest, which was nearly all completed, except in hilly districts, by the end of the month. The harvest was, however, rather protracted, largely owing to the break in the weather at the beginning of the month, and reports as to the condition of the crop when harvested vary a good deal; in the east more especially the reports are less satisfactory.

Lifting of the main crop of potatoes is hardly general yet, although it has been commenced in most places. Prospects have gone back somewhat during the month, and the yield is now estimated at some 3 per cent. below average; the deterioration being chiefly due to the spread of disease in some of the eastern and northern counties, as well as in the extreme south-west.

Roots have made very good progress during the month, especially turnips and swedes, which have been suited by the generally cool weather. They are expected now to be only about 2 per cent. below the average. Mangolds have not made quite so good an improvement, and would probably have been the better for more warmth, and they will probably yield from 3 to 4 per cent. below the average.

Little autumn cultivation has been possible, owing to the lateness of the harvest; and this work is backward with few exceptions. By the end of the month, however, ploughing of stubbles was beginning with good prospects of satisfactory progress, as conditions of weather and soil were generally favourable.

Seeds are, with some few exceptions, a full plant, strong and healthy, giving good promise for next year's crop. In the north, more particularly, they have grown vigorously.

Pastures are nearly everywhere green, and full of grass, although in some districts it is now of rather poor quality. Live stock are generally satisfactory, except for a certain amount of husk among cattle, which is reported from several parts of the country.

Agricultural Labour in England and Wales during September.

ACCORDING to the Board's *Monthly Agricultural Report* for 1st October, 1916, the supply of labour is still very short, and harvest wages have been high. The scarcity has, however, not seriously hindered the in-getting of the harvest, as help from soldiers and women was very generally obtainable, but here and there harvest operations were somewhat protracted from this cause.

The following local summaries give further details regarding agricultural labour in the different districts:—

Northumberland, Durham, Cumberland, and Westmorland.—Farmers were very short of men, especially skilled workers, and the harvest was protracted in consequence.

Lancashire and Cheshire.—Labour was very scarce, but harvesting operations were carried out successfully, although slightly protracted.

Yorkshire.—Labour was scarce, but, partly owing to the favourable weather, there was enough to secure the harvest. A deficiency of threshers was reported from some parts of the county.

Shropshire and Stafford.—Labour was still deficient, but female labour was tried in places with some success.

Derby, Nottingham, Leicester, and Rutland.—Labour was scarce, but women and soldiers were called in to help. Skilled labour was very difficult to obtain.

Lincoln and Norfolk.—Labour was still very short.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was getting more and more deficient, and with all work backward the shortage will be keenly felt.

Bedford, Northampton, and Warwick.—Labour was still scarce and wages high.

Buckingham, Oxford, and Berkshire.—Labour was very deficient, but there was a fair supply of casual labour in parts of Buckinghamshire.

Worcester, Hereford, and Gloucester.—The supply of labour was very deficient. In some districts women and boys have given good help,

and one reporter states that there was much less difficulty with hop-picking than was anticipated. Some threshing machines were reported to be idle for lack of men.

Cornwall, Devon, and Somerset.—Labour was scarce, but the crosp have been secured without undue delay from this cause. Harvest wages were much higher than last year.

Dorset, Wiltshire, and Hampshire.—The scarcity was keenly felt, and further depletion seemed probable.

Surrey, Kent, and Sussex.—Labour was still deficient, and casual labour was hard to obtain.

Essex, Hertford, and Middlesex.—Harvesting operations were successfully carried out with the assistance of the military, and the scarcity of labour, although marked, did not appear to have caused any serious neglect.

North Wales.—Labour was deficient in some districts, but farmers have assisted one another in many cases. Casual labour was still hard to obtain.

Mid Wales.—Harvesting and other work appeared to have been done with a minimum of inconvenience in this division ; but temporary labour was very scarce.

South Wales.—Labour was still deficient, and casual labour hard to obtain. Women were assisting in the work. Milk hands were scarce in parts of Glamorganshire.

The following statement shows that according to the information in the possession of the Board on 1st October, 1916, certain diseases of animals existed in the countries specified :—

Prevalence of Animal Diseases on the Continent.

Austria (on the 23rd Aug.).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Denmark (month of Aug.).—Anthrax, Swine Erysipelas, Swine Fever.

France (for the period 30th Aug.—2nd Sept.).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Swine Erysipelas, Swine Fever.

Germany (for the period 1st—15th Aug.).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (month of Aug.).—Anthrax, Glanders, Foot-rot, Swine Erysipelas.

Hungary (on the 23rd Aug.).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 4th—10th Sept.).—Anthrax, Black-leg, Foot-and-Mouth Disease (1,071 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of Aug.).—Anthrax, Blackleg, Swine Fever.

Rumania (for the period 5th—13th Aug.).—Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of April).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (18,289 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of May).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of Aug.).—Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period 4th—10th Sept.).—Anthrax, Blackleg, Foot-and-Mouth Disease (3 "étables" entailing 41 animals, of which 3 "étables" were declared infected during the period).

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during September.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.		Rainfall. Diff. from Average.	No. of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 2nd Sept.:								
England, N.E. ...	57·3	+0·7	0·48	12	— 4	3	4·8	+0·1
England, E.	58·2	—0·1	1·71	43	+29	5	4·0	—1·5
Midland Counties ...	57·3	0·0	1·06	27	+11	4	4·4	—0·4
England, S.E. ...	59·9	+0·3	1·76	45	+28	6	3·4	—2·3
England, N.W. ...	57·0	0·0	0·75	19	— 4	3	5·2	+0·7
England, S.W. ...	59·0	+0·9	2·22	57	+34	6	4·5	—1·0
English Channel ...	61·7	+1·0	2·29	57	+40	5	5·1	—1·4
Week ending 9th Sept.:								
England, N.E. ...	57·5	+1·6	0·98	25	+10	3	3·9	—1·0
England, E.	57·9	+0·1	0·42	11	— 1	3	3·9	—1·4
Midland Counties ...	57·7	+1·2	0·48	12	— 1	2	4·1	—0·6
England, S.E. ...	58·8	0·0	0·30	8	— 6	2	5·2	—0·3
England, N.W. ...	58·2	+1·9	0·88	23	+ 5	3	3·3	—1·3
England, S.W. ...	59·0	+1·4	0·18	5	—13	2	4·5	—0·8
English Channel ...	60·9	+0·9	0.18	5	— 9	2	6·4	0·0
Week ending 16th Sept.:								
England, N.E. ...	53·8	—1·2	0·10	3	— 9	2	4·5	—0·3
England, E.	54·6	—2·1	0·12	3	— 7	2	3·1	—2·2
Midland Counties ...	54·8	—0·9	0·07	2	— 8	2	3·7	—1·0
England, S.E. ...	56·6	—1·2	0·02	1	—10	1	3·9	—1·5
England, N.W. ...	54·6	—1·0	0·26	7	— 7	4	3·1	—1·6
England, S.W. ...	56·8	0·0	0·05	1	—13	1	3·2	—2·0
English Channel ...	58·6	—0·9	0·07	2	—10	1	5·0	—1·6
Week ending 23rd Sept.:								
England, N.E. ...	50·7	—3·2	0·37	10	+ 1	3	4·0	—0·4
England, E.	50·9	—4·6	0·59	15	+ 4	4	3·8	—1·2
Midland Counties ...	50·5	—3·7	0·43	11	0	3	2·8	—1·5
England, S.E. ...	52·5	—4·3	0·54	14	+ 2	3	4·6	—0·4
England, N.W. ...	52·3	—2·3	0·87	22	+ 5	3	3·0	—1·2
England, S.W. ...	54·3	—1·6	0·40	10	— 8	2	4·5	—0·2
English Channel ...	56·8	—1·9	0·51	13	— 2	2	4·7	—1·3
Week ending 30th Sept.:								
England, N.E. ...	54·1	+1·8	0·04	1	— 9	1	3·9	—0·1
England, E.	56·4	+2·8	0·08	2	—11	2	4·2	—0·2
Midland Counties ...	55·2	+2·8	0·17	4	—10	2	2·9	—0·9
England, S.E.... ...	57·5	+2·5	0·59	15	— 1	4	3·4	—1·1
England, N.W. ...	55·5	+2·7	0·15	4	—17	2	3·3	—0·4
England, S.W. ...	57·3	+3·0	1·41	36	+13	4	3·3	—0·9
English Channel ...	59·7	+2·1	1·93	49	+29	5	4·2	—1·0

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

Disease.	September.		Nine Months ended September.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	35	28	408	446
Animals attacked	38	30	481	508
Foot-and-Mouth Disease:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	24	—
Glanders (including Farcy):—				
Outbreaks...	7	3	43	40
Animals attacked	14	5	105	71
Parasitic Mange:—				
Outbreaks	78	63	1,790	644
Animals attacked ...	172	128	4,003	1,391
Sheep-Scab:—				
Outbreaks	13	4	197	164
Swine Fever:—				
Outbreaks	297	216	3,593	3,208
Swine Slaughtered as diseased or exposed to infection	184	716	8,805	14,045

The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

Disease.	September.		Nine Months ended September.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	—	3	1
Animals attacked	—	—	7	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	8	6	56	59
Sheep-Scab:—				
Outbreaks	49	29	327	319
Swine Fever:—				
Outbreaks	35	22	259	197
Swine Slaughtered as diseased or exposed to infection	228	125	1,612	1,125

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in September and August, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	September.		August.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	14 0	13 6	14 11	14 3
Herefords	13 0	12 6	14 2	12 10
Shorthorns	13 8	12 6	14 3	13 0
Devons	13 10	12 3	14 2	12 6
Welsh Runts	13 2	12 2	14 5	13 10
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	11¼	10½	13½	12
Sheep :—				
Downs	12¾	11½	12¾	11¾
Longwools	11¾	10¾	11¾	10¾
Cheviots	13½	12½	13½	12½
Blackfaced	13¼	12	13¼	12¼
Welsh	12	11	12½	11¼
Cross-breds	12¾	11¾	12¾	11¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	13 0	12 3	12 8	12 0
Porkers	13 8	13 1	13 3	12 8
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	37 2	30 4	36 4	28 12
,, —Calvers ...	36 5	29 12	35 4	28 3
Other Breeds—In Milk ...	35 7	26 16	32 2	25 6
,, —Calvers ...	27 0	25 0	25 0	24 0
Calves for Rearing	3 8	2 14	3 11	2 15
Store Cattle :—				
Shorthorns—Yearlings ...	14 13	12 11	14 11	12 17
,, —Two-year-olds...	22 1	18 8	22 0	18 15
,, —Three-year-olds	27 12	24 12	29 6	24 10
Herefords —Two-year-olds...	21 7	18 11	23 7	19 2
Devons— ,,	21 15	18 9	21 12	18 11
Welsh Runts— ,,	21 15	18 1	24 7	19 17
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	54 1	46 0	55 0	46 0
Store Pigs :—				
8 to 12 weeks old	36 5	28 2	36 6	28 4
12 to 16 weeks old	54 6	42 6	56 7	44 7

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in September, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	90 6	90 6	—	90 0	86 6
	2nd	85 6	88 0	—	83 0	83 0
Cow and Bull	1st	81 0	83 6	77 6	77 0	80 0
	2nd	74 0	77 0	67 0	72 6	75 0
Irish: Port Killed	1st	—	88 0	88 0	87 6	84 0
	2nd	—	85 0	82 0	81 0	80 0
Argentine Frozen—						
Hind Quarters	1st	80 0	—	—	—	—
Fore ,, ...	1st	69 0	—	—	—	—
Argentine Chilled—						
Hind Quarters	1st	90 6	88 6	88 0	88 6	88 0
Fore ,, ...	1st	72 6	70 0	68 0	70 0	68 0
Australian Frozen—						
Hind Quarters	1st	—	—	—	—	—
Fore ,, ...	1st	—	—	—	—	—
VEAL :—						
British	1st	108 6	—	—	116 6	—
	2nd	102 6	—	98 0	98 0	97 0
Foreign...	1st	—	—	—	—	—
MUTTON :—						
Scotch	1st	105 0	—	—	116 0	108 6
	2nd	102 6	—	—	108 6	104 0
English...	1st	107 6	113 0	—	109 6	104 0
	2nd	104 0	107 6	—	100 6	99 0
Irish: Port Killed	1st	105 0	—	99 0	101 0	102 6
	2nd	102 6	—	94 6	93 6	98 0
Argentine Frozen	1st	85 6	85 6	81 0	82 0	81 0
Australian ,, ...	1st	—	—	—	—	—
New Zealand ,, ...	1st	83 0	—	—	84 6	—
LAMB :—						
British	1st	109 6	121 6	114 6	121 6	114 6
	2nd	106 0	112 0	106 0	112 0	109 6
New Zealand	1st	95 6	94 6	95 6	93 6	95 6
Australian	1st	—	—	—	—	—
Argentine	1st	95 0	98 0	90 0	92 6	90 0
PORK :—						
British	1st	111 6	108 0	108 6	114 6	103 0
	2nd	105 0	102 6	98 6	102 6	97 0
Frozen	1st	—	90 6	—	98 0	—

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in September, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	20 0	19 0	—	—	20 6	19 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	188 6	184 6	188 0	184 0	188 6	184 6
" Factory	169 6	160 6	—	—	171 6	165 0
Danish...	—	—	200 6	198 0	200 0	196 6
French...	—	—	—	—	179 6	175 0
Dutch	—	—	—	—	184 6	181 0
American	—	—	—	—	179 6	174 6
Canadian...	185 0	181 6	—	—	186 0	180 6
New Zealand	188 0	184 0	—	—	189 6	186 0
Argentine	—	—	—	—	186 0	182 6
CHEESE:—						
British—						
Cheddar	116 0	106 0	119 0	111 6	116 0	108 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	125 0	120 0	126 0	119 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	107 0	104 0	107 6	104 6	106 0	104 0
BACON:—						
Irish (Green)	127 6	118 6	121 0	119 0	120 0	116 0
Canadian (Green sides)	114 6	112 6	114 0	110 6	115 0	111 6
HAMS:—						
York (Dried or Smoked)	162 0	156 0	—	—	160 0	154 0
Irish (Dried or Smoked)	—	—	—	—	149 6	143 6
American (Green) (long cut)	106 6	102 6	107 6	103 0	107 0	103 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	24 7	22 6
Irish	21 10	—	21 10	19 8	22 10	21 10
Danish	—	—	—	—	24 3	22 3
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen... ...	145 0	135 0	148 6	138 6	140 0	130 0
Edward VII.	161 0	137 6	148 6	141 6	143 6	133 6
Up-to-Date	145 0	132 6	140 0	131 6	143 6	133 6
HAY:—						
Clover	—	—	157 6	142 6	157 6	148 6
Meadow	—	—	—	—	157 6	148 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 8 ...	30	11	46	2	55	8	25	11	29	7	47	8	18	4	26	5	31	5
,, 15 ...	31	0	48	9	56	7	26	0	30	5	48	6	18	6	27	6	31	11
,, 22 ...	30	11	51	6	57	2	26	3	31	3	49	6	18	11	28	10	32	6
,, 29 ...	31	1	52	8	58	0	26	6	32	5	51	0	19	1	29	10	32	11
Feb. 5 ...	31	0	53	3	58	3	26	7	33	7	52	5	18	9	30	3	32	4
,, 12 ...	31	0	54	8	57	6	26	7	34	7	52	10	18	11	31	1	32	2
,, 19 ...	31	0	56	0	56	11	26	7	34	11	53	6	18	11	31	5	31	9
,, 26 ...	31	0	56	0	58	2	26	6	35	3	54	2	18	11	31	8	32	2
Mar. 4 ...	31	5	55	11	59	4	26	2	34	6	55	7	18	9	31	8	32	4
,, 11 ...	31	6	54	8	58	2	26	0	33	5	55	6	18	7	31	0	32	3
,, 18 ...	31	5	53	9	57	9	25	8	32	2	55	4	18	6	30	7	31	10
,, 25 ...	31	4	54	3	55	11	25	7	31	11	54	6	18	8	30	6	31	4
Apl. 1 ...	31	6	54	6	53	6	25	6	31	9	53	8	18	5	30	6	30	5
,, 8 ...	31	5	54	9	51	8	26	8	31	3	53	7	18	4	30	4	30	1
,, 15 ...	31	7	55	4	53	2	25	4	30	10	53	1	18	4	30	5	30	7
,, 22 ...	31	9	56	5	55	3	26	6	31	5	52	10	18	5	30	11	31	8
,, 29 ...	31	9	58	3	56	3	26	0	32	7	53	5	18	5	31	5	32	4
May 6 ...	32	2	60	5	55	7	25	6	33	3	53	1	18	9	32	4	32	10
,, 13 ...	32	7	61	7	55	5	26	3	34	0	53	5	18	11	32	5	33	1
,, 20 ...	33	0	62	0	55	0	25	10	34	1	52	10	19	0	32	8	33	0
,, 27 ...	33	9	61	11	54	7	26	1	34	8	52	9	19	4	32	7	33	4
June 3 ...	34	0	61	9	53	3	25	11	35	4	53	9	19	4	32	5	33	3
,, 10 ...	34	1	60	1	51	2	24	11	34	5	52	8	19	8	32	4	32	7
,, 17 ...	34	1	56	1	48	10	25	10	34	3	50	9	19	9	31	9	32	1
,, 24 ...	34	3	52	0	47	6	25	4	34	4	49	10	20	0	31	9	31	3
July 1 ...	34	4	49	5	46	3	24	6	35	3	49	1	19	9	31	1	30	10
,, 8 ...	34	2	50	1	46	3	24	9	34	7	45	6	20	0	31	6	30	8
,, 15 ...	34	1	52	7	48	11	24	2	35	8	47	5	19	10	31	6	31	6
,, 22 ...	34	0	53	10	51	6	24	7	35	10	48	8	19	9	32	1	32	3
,, 29 ...	34	2	55	3	53	5	25	9	36	1	47	2	19	8	31	1	32	5
Aug. 5 ...	34	9	55	4	55	1	25	2	35	7	46	1	19	1	31	5	32	9
,, 12 ...	40	3	55	2	56	7	29	4	37	0	46	11	25	1	31	7	31	2
,, 19 ...	38	9	54	3	58	1	29	10	39	4	48	0	24	3	31	4	30	8
,, 26 ...	36	2	51	11	59	0	30	3	38	3	47	1	23	5	30	0	31	6
Sept. 2 ...	36	5	45	3	59	4	30	6	38	1	48	5	23	9	26	10	30	5
,, 9 ...	37	10	43	0	59	3	29	11	37	11	51	7	23	11	26	8	31	1
,, 16 ...	38	3	42	9	59	11	29	5	39	0	52	6	23	8	26	4	30	9
,, 23 ...	37	6	43	3	59	4	29	3	39	8	53	3	23	3	26	1	30	9
,, 30 ...	37	1	43	5	58	10	29	1	40	4	54	1	22	9	26	5	31	1
Oct. 7 ...	36	8	44	1	59	2	28	10	41	0	54	5	22	5	26	5	30	9
,, 14 ...	36	7	45	9			28	8	42	3			22	4	27	1		
,, 21 ...	37	2	48	2			28	7	44	0			22	5	28	1		
,, 28 ...	37	10	50	3			28	3	46	2			23	7	29	1		
Nov. 4 ...	38	8	51	6			28	6	47	3			23	7	30	4		
,, 11 ...	39	8	52	8			29	0	47	5			24	8	30	11		
,, 18 ...	41	0	53	6			29	8	47	11			25	5	31	3		
,, 25 ...	41	11	54	2			30	3	48	7			25	8	31	1		
Dec. 2 ...	42	2	53	7			30	2	48	11			25	9	30	11		
,, 9 ...	42	1	52	10			29	11	47	10			25	9	30	4		
,, 16 ...	42	7	53	11			29	8	47	5			25	9	30	6		
,, 23 ...	43	3	53	10			29	9	47	2			25	11	30	7		
,, 30 ...	44	4	54	9			29	10	47	5			26	6	30	10		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of September, 1914, 1915, and 1916.

—	Wheat.						Barley.						Oats.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	39	2	44	4	60	7	30	0	40	4	53	7	25	0	27	9	32	10
Norwich ...	37	3	44	1	56	11	29	4	38	4	49	7	23	10	25	10	30	7
Peterborough	37	0	41	11	58	7	28	9	38	6	53	0	23	6	26	0	29	7
Lincoln ...	37	5	44	1	59	9	29	3	38	8	52	1	23	3	26	9	30	3
Doncaster ...	36	6	44	2	59	6	27	2	36	10	53	10	23	1	27	7	31	4
Salisbury ...	37	6	43	11	58	5	29	7	38	8	49	9	23	8	27	0	31	0

NOTICES OF BOOKS.

A Short History of English Rural Life from the Anglo-Saxon Invasion to the Present Time: Montague Fordham, M.A., with a preface by Charles Bathurst, M.A., M.P. [*London*: George Allen & Unwin, Ltd., 2*s*. 6*d*. net.]

This is an elementary manual for the student and general reader in which the author seeks to trace the general features of English village life to the present day. Its different sections are based upon the works of recognised authorities. Part I. deals with "Mediæval Rural Life," from the period of the Anglo-Saxon Settlement to the Peasant's Revolt; Part II., with "The Reconstruction of Rural Life," from the break-up of the manorial system in the fifteenth and following centuries to the changes in agriculture in the eighteenth century, which were the counterpart of the Industrial Revolution; Part III. deals with "Reconstructed Rural England" of the nineteenth and twentieth centuries, and the efforts made to improve the position of the agricultural labourer.

Appended are notes upon various terms, upon inclosures and agricultural rents, and also lists of Statutes dealing with agriculture and other relevant matters.

Milk and its Hygienic Relations: Janet E. Lane-Claypon, M.D., D.Sc. (Lond.), (348 pp.). [*London*: Longman, Green & Co., 1916, 7*s*. 6*d*.]

Dr. Janet Lane-Claypon, an assistant medical inspector under the Local Government Board, was invited by the Medical Research Committee to assist them in collecting the available scientific evidence upon the hygienic relations of milk, and this book represents her efforts in that direction.

The book presents a collection of the titles and critical summary of the published works of a large number of investigators, and is intended to help research workers and others interested in the subject of milk from a public health point of view, rather than agriculturists.

(4624) P. 13—50. 7,500. 10/16. J. T. & S., Ltd.

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AGRICULTURE AND THE WAR.

REPORT OF A MEETING BETWEEN

The President of the Board of Agriculture and Fisheries

AND

Members of the Somerset War Agricultural Committee, and Others, at Taunton.

A MEETING was held at Taunton on 28th October last between The Earl of Crawford and Balcarres (President of the Board of Agriculture and Fisheries) and members of the Somerset War Agricultural Committee, and others. The Chair was taken by The Right Hon. Lord St. Audries, who was supported by The Marquess of Bath, The Earl Fortescue, K.C.B., The Earl of Waldegrave, The Lady Hilton, and Lieut.-Colonel Earle. Lord Crawford was accompanied by Mr. E. J. Cheney (Chief Agricultural Adviser of the Board) and Mr. F. Horne (Small Holdings Commissioner of the Board).

The CHAIRMAN briefly introduced Lord Crawford, who then addressed the meeting:—

LORD CRAWFORD: Lord St. Audries, Ladies, and Gentlemen,—As our Chairman has said, the conditions under which this meeting is held are difficult conditions, difficult from many points of view; and for that reason it is necessary to hold these meetings to take counsel one with another, and to ensure that every possible effort shall be made to help the agriculture of the country through this great crisis. (Hear, hear.)

We all know the difficulties. There are labour difficulties; there are tillage difficulties; we have had a late harvest, and that means a late autumn; and, above all, there is a difficulty to

which I shall refer later on, namely, the feeling of uncertainty which hangs over agriculture to-day. (Hear, hear.)

Let us start by considering what our object is. I mean not the object of farmers alone, but the object of the country as a whole in relation to agriculture as a whole. We want more food. Now ten years ago agriculture was simply looked upon by the country at large as an industry. To-day, agriculture is recognised by the country to be a source and foundation of national strength. Ten years ago agriculture was merely a commercial occupation and not always very brilliant at that. To-day, agriculture is one of the weapons by which Britain means to win the great War; and so public estimation of agriculture is changing. So the public comes bit by bit to realise that it requires more food, and it is almost a discovery to the British public to-day. Hitherto food has reached this country somehow and from somewhere,—it was not the business of the consumer to enquire how it came, or when it came, or whence it came. He asked no questions. Too often he closed his ears to those who pointed out the danger of allowing agriculture to be neglected and to decay. Now he is beginning to find that it is not merely more food that is required, but that the source and the origin of that food is one of the essential values of the foodstuff itself when required by the consumer.

Every quarter of corn that we import weakens the country in comparison with the strength that every quarter of corn which we grow confers upon the country. If we buy the corn abroad, we have to pay for it abroad. During war, one financial transaction of all others that we desire to avoid, is sending our money abroad to purchase articles which can be produced at home. Such a course weakens the British exchange; it diminishes our financial resources; and the financial resources of this country are one of the great weapons by which we are fighting this war. So that, if we buy the corn abroad, we weaken our Exchange, we make a fresh call upon the Mercantile Marine which could be used for more profitable transactions; and, when we get the corn here, it requires fresh labour; unloading at the docks, re-loading into trains, distribution, and so on, which one may justly say converts the importation of corn stuffs during the war from being a strength to being a weakness to the whole country.

Wheat.—Now let me say a word or two about the position of the two fundamental foodstuffs on which we depend: wheat and meat. Our last harvest showed a serious decrease in the area of wheat compared with 1915. This summer, in England

and Wales alone we harvested over a quarter of a million less acreage under wheat than during 1915, and I am afraid that the average yield over that reduced acreage will be considerably lower than it was last year.*

We are considering to-day the prospects of the wheat for next summer. I am going to urge you to-day (and I hope through the Press to reach a wider audience than is gathered in this hall) to use every endeavour to plant the maximum area of wheat during the *coming* months. I do not think we can expect to reach the high figure harvested in 1915; but what can be done should be done, and must be done. I am quite certain that to do so will pay the farmer. Prices will be remunerative next August, even if peace were declared at Easter; and not only am I convinced that it will pay the farmer, but that it will pay the country too. And I would ask you to recollect that the only basis on which the Board of Agriculture can press for the retention of all possible labour, is that all labour which is now available is being used to the utmost in the national interest, regardless of whether the ultimate profit is going to be large or small. So much for the wheat side of the food problem.

Live Stock.—Let me for a moment turn to the question of stock. Somerset is a county where the work started by the Board of Agriculture in connection with the Live Stock Improvement Scheme has been taken up as successfully as, if not more successfully than, in any other county in England. The first grant under our Live Stock Scheme was made only six months before war broke out; but the farmers of this great county have so well appreciated the value of the scheme and what it represents, that Somerset is now earning the maximum grant which we are entitled to pay you, namely, the sum of £1,000 a year.

I should like to quote just a few figures about the live stock societies in the county. At the present time there are 17 subsidised boars, averaging £7 6s. in value apiece; 34 bulls, averaging over £40 apiece, and a good record as regards Shire horses. When I say that the bulls belonging to these societies are worth on the average over £40 apiece and that they replaced bulls which, before the Live Stock Scheme, on the average certainly did not reach £25 in value, you will realise the improvement which has been effected in the very short time that the scheme has been in operation.

Then as regards milk recording societies, I should remind you that the first society under the Board's scheme was estab-

* The Board have since issued returns as to the yield of wheat (see p. 803).

lished at Cadbury in the month of April, 1914, and its members and others have realised that a milk recording certificate has a definite commercial value. There are two other societies in Somerset; and in spite of all the difficulties—shortage of milkers and other war difficulties—the progress made by all these three societies is satisfactory.

I want to insist upon the value of this live stock improvement, not merely from a local point of view, but because live stock is going to present one of the great problems of the future. It is not yet sufficiently realised in this country, how much more as time goes on we are going to have to depend upon our own resources. A very short time ago the United States of America was an enormous exporting country. Per head of population, it is the biggest meat-eating country in the world. England is the third greatest meat-eating country in the world and the largest in Europe; our requirements, which are already gigantic, show every sign of increasing; and while that process is going on, great exporting countries like the United States of America are finding it more and more necessary to reserve their meat for their own home population. Therefore, although new markets will naturally tend to develop themselves elsewhere, in America or in Africa, for instance, fresh demands will at the same time be made upon the stock owners and stock breeders at home. We have to take our share in this increased provision of meat; and if, in addition, you remember that the flocks and herds of certain parts of Europe have been devastated (Germany, herself, since the war began has lost a million head of stock)—if you realise what the ravages of war are, I hope you will equally realise how great is the obligation upon us to use every means at our disposal to supplement and to maintain our flocks and our herds.

Now let me refer to the actual statistics of live stock on the 5th June last, when the annual records were compiled by the Board of Agriculture. There was a larger head of cattle in England and Wales then than at any recorded date in our history. It is really a most astonishing thing that after two years of war we could show an economic position so strong. Since June over four months have elapsed; and I should think that if a census were taken to-day the figure would not be so high. But none the less during war time, and especially bearing in mind the extraordinary figures I have told you which prevailed on the 5th June, bearing in mind the fact that we have been two years at war, I say that this country is entitled to some extent to draw upon its capital. But I greatly hope

that, although war pressure will drive us in that direction, agriculturists are not going to yield to the ready temptation of high prices thus to diminish or to disperse their herds. A good herd is a great asset to-day, but a good herd twelve months after the declaration of peace will be a still greater and more precious asset. Every head of cattle that we can maintain over the War in itself is strengthening the country as a reserve during the War, and will greatly add to the strength of agriculture and its power of recuperation after the War.

But wheat, live stock and cropping—all these things depend upon adequate labour; and there is plenty of evidence to show that labour is inadequate to maintain our normal standard of cultivation.

Labour Shortage.—Referring again to the Official Returns collected on the 5th June, there was an increase this year, compared with last year, of 112,000 acres which were lying in bare fallow. Now I have not a doubt in my mind that that increase in bare fallow is an increase caused by labour shortage; bad labour shortage means bad cultivation, bad cultivation means poor yields and means dirty land, which means two or three, or in some cases four years, before the qualities of the soil can be fully restored. Those are the difficulties which farmers have to face, and they are the difficulties which agriculture must continue to face, and which agriculture has got to overcome.

What is the central War position in so far as it affects agriculture? In the first place, the army says it wants more men, the nation says it wants more food, and the farmer says he wants more labour. I must say, ladies and gentlemen, it is the stiffest proposition I have ever been up against.

Now I should like to refer to the recent circulars issued by the War Office, to the Census of Agricultural Labour which the War Office is going to take, to the Scheme of Substitution, to Dilution of Labour, to the work of the War Agricultural Committees, and to the work of the Women's County Committees.

War Office Circular, 4th October.—I begin by reminding you of what is too often forgotten, namely, that in the circular sent out by the Army Council on the 4th October, it was decided that, subject to conditions to which I am going to refer, "no more men from amongst those now employed in agriculture will until January 1st, 1917, and in the case of men whose whole time employment on a holding is necessary for maintaining milk production, till the 1st April, 1917, be called to the

Colours except in return for men released from the Colours for work in agriculture." So far, so good. We have this pledge, that, unless a substitute can be found, no more men from among those now employed in agriculture can be withdrawn from their work before January, or, as regards men employed in whole time dairy work, before the end of March. That is so much gained and so much time in hand, and valuable time from the point of view of husbandry. For every acre of wheat sown in the spring in this country as a whole, 15 acres are sown during the winter. I do not forget that the ploughman is necessary after the 1st January just as he is before the 1st January; but at least he is secured until the end of the year and, whenever it can be shown that he is necessary and within the scale for the cultivation of the land, the anxiety of our Department is to ensure that he shall be retained for further cultivation.

War Office Census.—The War Office is going to take a census of male and female workers now employed on agricultural holdings; and this census form will be issued, I understand, by the War Office in the course of a day or two. The census will be conducted by the War Office, that is to say, under the authority of the War Office, and I gather that the form is to be returnable on or about the 15th November. As I read to you just now, its object is to enable the Military Authorities to make a survey of the whole position of agriculture. Its object is to see whether, having regard to the Labour Scale and to local conditions, the labour available is either sufficient, excessive, or deficient. My impression—and it is only an impression—is, that the result of the War Office census will show that, taking the country as a whole, not only are few men employed over the so-called Labour Scale, but that in a great many districts the number of men employed is well below that standard. The Labour Scale of course is not, and never has been, a fixed, rigid rule. It was intended to serve as a general guide to the authorities, not necessarily versed in agriculture at all, as to what labour should be properly left upon the farms to ensure a reasonable standard of cultivation.

The Labour Scale.—I have been asked, is the Labour Scale permanent; will it be maintained after the end of December and after the end of March? Nothing in time of war can be said to be permanent. Military requirements change from week to week, sometimes, indeed, they change from day to day; and there can be no guarantee given by the War Office that the Labour Scale is permanent, any more than a guarantee can be given that the age for Military Service shall not be raised over

its present limit, or that the income tax shall not be increased next year. But this much I think I can say: that the Labour Scale will not be altered unless the military situation demands it; and it is worth remembering that the actual terms of the Labour Scale are set out in full in the circular which has just been issued by the War Office on the subject. Moreover, the War Office in their official book on Registration and Recruiting issued to their officers, set out the Labour Scale, preceded by this announcement: "The necessity of producing food, if possible, in excess of the usual production, should be appreciated by all Recruiting Officers and Military Representatives." And they go on elsewhere to say that "The Military Representatives are specially enjoined to watch the list of certified occupations, and to carry out the spirit of the instructions laid down by the various Departments concerned." Just in the same way, the Local Government Board in their recent communication to the Tribunals say: "Particular attention should be paid to the official list of certified occupations, which states the classes or bodies of men engaged in agriculture whose work has been certified after consultation with the Army Council as being of national importance," the reason being that the Labour Scale, rough and ready guide as it is, represents the minimum amount of labour which is necessary for proper husbandry in time of war. Although, therefore, the War Office cannot give a guarantee that the Labour Scale will be maintained intact, you will see from the quotations I have given you from their own circulars that they understand how necessary the Labour Scale of employment on that standard is for the due cultivation of the land. At this point may I please offer a word of advice to farmers. Pray do not pay over much attention to the market gossip which passes from mouth to mouth. You hear a Military Representative has said this, or that a member of some Tribunal has said that, or that some newspaper or other has said so and so; and then farmers begin to worry and they are harassed. They ask themselves if it is good enough carrying on, and they then get into a panic, and say they will sell off their stock. A farmer who says that is doing an injustice to himself, and he is also doing an injury to the nation. There are plenty of other industries which are worried as well; and the farmer should remember that he has got some good friends left in the world; that there is a Department, even if it be in a despised street called Whitehall, whose business is to look after and to safeguard the interests of agriculture as a whole. You must trust the Board of Agriculture to do its utmost, even if

and even when the utmost of a Government Department does not fulfil all your expectations. But I think we must also trust the War Office to play the game, too. I am quite sure that the War Office knows the strategic value of food even better than farmers know it themselves. I say our duty is to watch the matter closely, and to make representations whenever and wherever we see that a case is not receiving due attention.

My Department long ago laid the whole of our case before the new authority, called the Man-Power Distribution Board, which has been set up by the Government. We investigate every case of hardship that is sent up to us; and, of course, cases of hardship, sometimes indeed cases of injustice, are unavoidable. If you realise that in England and Wales there are no less than 1,850 separate Tribunals, you will understand that disparity of treatment is inevitable, and of course it falls to our lot to represent to the War Office those cases where we think agriculture is being badly treated. At the same time it is our duty—and we fulfil it—of refusing to intervene in favour of the farmer, where we do not think that the farmer is playing the game by the country and by the army. So, therefore, we look upon ourselves as the advocate of agriculture; and you may be quite sure, Ladies and Gentlemen, that we lose no opportunity of pressing upon the authorities that if they want to take men, they had better take men who are engaged, shall I say, in manufacturing tobacco rather than those who are engaged in cultivating wheat.

Substitution of Labour.—I now come to this difficult question of substitution. The War Office propose to withdraw no more men from among those now employed in agriculture, as I read to you just now (before January or April, as the case may be), unless substitutes are sent to replace them. In the first place, you must understand that substitution applies to all industries, not only to agriculture. In every district a Substitution Officer is going to be appointed by the Military Authorities. Many Substitution Officers have already been appointed, and the Board of Agriculture's representatives can ascertain their names by asking the Officers Commanding the recruiting areas. Now that Substitution Officer has already got prepared lists of possible substitutes. These substitutes are men now serving in the Reserve—soldiers who are looking after railway bridges, for instance, or watching munition works. The list of substitutes is classified according to districts, and many of those lists are actually being sent out to-day to Substitution Officers in different parts of the country.

The Board's representative—or indeed, any authorised person —is at liberty to see these lists and he can look up a particular district to see the names and what reservists can be sent to replace young and able-bodied men now working on farms. Will the substitute be as efficient as the man he replaces? I dare say not. In the first place, he will probably be 20 years older; but he will be a trained agriculturist and he will belong to the district. We have told the War Office that it is no good sending a Yorkshireman to work in Dorsetshire or a Dorset man to work in Yorkshire; and in many cases it is hoped that it will be possible to arrange for the reservist to come back to his own village and to his own home, where his family now is, and to work in the same occupation at which he was working on the day that war broke out. So you see in a very few days the name of the Substitution Officer will be known; the Board's representative will be in communication with him, and the lists of substitutes available will be known to those who are watching the interests of agriculture. As regards the man's wages, it will be the duty of the Board's agricultural representative and the Area Commander to satisfy themselves that the wages offered to the substitute are fair and in accordance with the rates at present ruling in the district.

Adjustment of Differences.—Then as regards any difference or disagreement which may arise between a farmer and a reservist; this will be dealt with by the Area Commander, if necessary, in consultation with the Agricultural Representatives. If the difference cannot be adjusted and the man is recalled to the Reserve, the War Office have promised to do their best to ensure that another substitute shall be found, if it is clear that the fault is not on the side of the employing farmer. But I would just like to add this from the War Office circular to the Officers Commanding recruiting areas: "It must be borne in mind in dealing with the whole of this question that all parties concerned must be prepared to work together if the scheme is to be successful. The farmer should be informed of the real urgency that exists for general service men when he is approached with a view to substitution. The man should be instructed that he is being sent back to work at agriculture primarily not for his convenience or advantage, but to assist his country in the War; and that petty discomforts inseparable from such a scheme are not to be made the subject of frivolous complaints to Officers Commanding areas, or to be used as an excuse for not rendering the best service possible to his employer."

Dilution of Labour.—Now, from substitution, let me turn to the rather bigger question of the dilution of labour. Dilution of labour is essential to our success in the War. It is not adequate in England as it is in France. It has been a miracle to me to see how French women and children and old French people have succeeded in maintaining the standard of cultivation in France right up to within a few hundred yards of the firing line. It is a marvellous tribute to the perseverance and to the courage of that race, and all who have been to France, and any soldier who has returned here, will tell you that it fills our Army with respect and with admiration. We shall not achieve the same thing here, but we have to do a great deal towards it. Labour was not too plentiful at the beginning of the War. Since then, as you know, the number of labourers has enormously decreased. At the outset only 9 per cent. or so of the male population was engaged in agriculture; but we still have part of the nucleus, with which we started when war broke out, of men who were under military age and men who were over military age. At the last census there were 153,000 persons occupied in agriculture below the age of 18, and 405,000 over the age of 41. In other words, there were 558,000 persons out of a total agricultural figure of 971,000 not subject to military duty. Many of those have been lost. Some since the census have come into military age, and others, above military age, have gone elsewhere; perhaps, indeed, have joined the Army either as volunteers or as reservists. But still, do not forget that we have that central nucleus to work upon, around which the diluted labour must be distributed.

Occasional Soldier Labour.—I want also to remind you of what I think has been rather overlooked, namely, that soldier labour can still be obtained by farmers. It is not only at corn harvest, but now, to-day, if you like, Employment Exchanges will send soldiers for occasional labour. In the case of a farmer living in the neighbourhood of a Military Station, there is no objection to his applying direct to the Commanding Officer for military labour which he requires at short notice, and for a period not exceeding six working days. This may enable the farmer to take advantage of fine days or short intervals of fine weather suitable for work; not more than four consecutive weeks' furlough can be given to any one man obtained through Employment Exchanges.

Convalescent Soldiers.—Then one other source of labour I should like to refer to is the work of convalescent soldiers. The depot at Chichester of the Royal Sussex Regiment has,

in the last two years, sent out soldiers for light agricultural work to the aggregate of 22,000 working days of labour. That is one smallish depot in one particular county. The work, of course, is light work. A soldier home under those conditions cannot do heavy work, but he can do useful work; and I can imagine nothing better for the soldier himself—some man who is brought home suffering from shell shock, we will say—than to do light work on a farm. I wish that the Military Authorities could do elsewhere what has been done with so much credit by the authorities of the Royal Sussex Regiment at Chichester.

Training of Children in Milking.—Now one further question was sent to me the other day, as to whether children could be employed and whether instruction could be given to them in milking. It is a question primarily for the Local Education Authority as part of their control of secular education under Section 5 of the Act. If, when the Local Education Authority thinks it desirable to give such instruction, a satisfactory scheme for the purpose were submitted to His Majesty's Inspector, the Board of Education would be prepared to approve it experimentally.

War Agricultural Committees.—Let me come to the last aspect of the Labour Question, and one of the most difficult. That is the question of women's work. The provision of local work must largely rest in the hands of the War Agricultural Committees and the Women's County Committees. Let me say a word about each. Some of the War Agricultural Committees are as active, zealous and efficient as anybody could desire; others are not. There are War Agricultural Committees in this country which did not meet for four and for five months during the summer. Those are committees which do not understand their duty, and are not fulfilling their responsibility to the State. War Agricultural Committees, where they are weak, must, accordingly, be strengthened. If there are members who cannot attend, they should be replaced by members who can and will attend. Whenever necessary, new members should be added; and, wherever possible, it is desirable to add farmers of experience and judgment. It is certainly desirable also that women should be co-opted to the War Agricultural Committees, just in the way that men should work in the closest co-operation with Women's County Committees.

You might think it unnecessary to say these things; unfortunately it is not. I am not referring to Somerset; it does not apply to Somerset. But this will reach other parts of the

country, and I am anxious that it should. Where these War Committees have failed to fulfil their duties, they must now realise that if things seemed simple and easy-going in the summer, duties are much more stern and responsibilities are much more severe now than they were six months ago. We look to these committees to help us in every way and to give us the fullest possible information on all points, which, as time goes on, concern and affect the future of agriculture.

Women's County Committees.—The Women's Committees hitherto have been closely associated with the Board of Trade. My Department has been in conference with the Board of Trade on the subject; and we have come to the conclusion that it will add to the efficiency of the Men's Committees and of the Women's Committees and to their future co-operation, if in future the Women's Committees are more closely connected with the Board of Agriculture than in the past.

There is great scope for the Women's County Committees, and they have to overcome great difficulties. Women's work is not very easily obtained, and I think that the committees will find that one of their first duties is to strengthen the personnel of the Village Registrars. The parish, after all, is the local unit; the parish is the nearest to the individual farmer and the individual farmer is nearest to the parish, and it is from the parish that the bulk of the women's work will be drawn. Much valuable work has been done by importing women from other parts of the country. But it is, after all, on the local women that we must depend, and on the local women secured through the parish or the Parish Registrar, and again, through the Women's County Committee, that we must look to supply this source of labour. As regards the various committees, they will have the help, I hope, of officers of the Board of Trade, who will be called co-operating officers, and who will work in co-operation with the Board of Agriculture; and, meanwhile, my Board is approaching the Treasury to secure that the Women's Committees shall have proper payment for their clerical and other work.

Women's Work.—Let me offer a general remark or two about women's work. There is prejudice amongst farmers against women's work. (No.) Oh, yes there is. I told you I was not referring to Somerset.

A VOICE: It is the women against the work.

LORD CRAWFORD: And it is natural, considering how short has been the period in most parts of this country since war began, when they first devoted themselves to farm work.

It is not surprising that their efficiency, quite apart from physical conditions, should be smaller than that of trained men. But it is wonderful what you can do when you try. Our army in France to-day, I imagine, is not so efficient as the incomparable force which left this country in the autumn of 1914—probably the finest army, although it was small, which the world has ever seen; and yet the army to-day, not perhaps so highly skilled, or so fully professionalised as the original Expeditionary Force, is none the less by dint of patriotism and zeal, a really magnificent army as well. I am quite sure that if, with proper care and training, women can be given a similar chance in those classes of agricultural work for which they are fitted, that the assistance they could render to us will be proportionately great. Two years ago there was not a woman in the country who knew anything about making ammunition; and yet to-day it is upon the women that we so largely depend for our output of shells and munitions. Even if their work does not conform to the standard to which agriculture was accustomed before the War began, we must realise that we are at war, and that we cannot maintain all our industries on the high scale of efficiency we should like to preserve, and that we must use every class of labour which the circumstances permit us to employ.

Now, Ladies and Gentlemen, I have tried to state fairly and impartially the assets and liabilities of agriculture. I have pointed out to you the agencies at our disposal, and the difficulties we have to face. Remember, I said that the Nation must have more food, and that agriculture requires more labour, and that the army claims more men; and yet we are not asked to reconcile the irreconcilable. If we will face the situation, we can fulfil our obligations by frank and by open-handed co-operation. There must be no waste, no relaxation of energy or effort, no reservation, no rest. Agriculture, after all, has shown courage and tenacity in the past. The issues at stake to-day are larger and more far-reaching than ever before. Let agriculture determine to overcome this supreme crisis in our history, and I feel confident that we can succeed.

(Lord Crawford then answered two or three questions which were put to him.)

LORD FORTESCUE then briefly moved a vote of thanks to the President of the Board, and, after it had been seconded by Mr. Samuel Kidner, and received with enthusiasm, the meeting terminated.

PALM KERNEL CAKE.

A SUMMARY OF INVESTIGATIONS MADE IN THE UNIVERSITY OF LEEDS.

CHARLES CROWTHER, M.A., Ph.D.

Professor of Agricultural Chemistry and Director of the Institution for Research in Animal Nutrition, The University, Leeds.

DURING the past two years the attention of the British farmer has been repeatedly directed to the merits of palm kernel cake and meal as food for stock, and to the desirability, both on Imperial and economic grounds, of a rapid, large and permanent extension of the use of these feeding-stuffs. The recently issued Report of the Committee on Edible and other Oil-producing Nuts and Seeds indicates clearly how great are the issues at stake and what substantial benefits may accrue both to agriculture and to the general national interest from the development of a large and steady home market for these feeding-stuffs.

Palm kernel cake and meal are not entirely new to British agriculture, but for many decades they have found little use except as ingredients of various proprietary compound cakes and meals of whose composition the farmer has had no knowledge.

With a view to stimulating interest in these feeding-stuffs and to acquiring more precise information as to their merits a series of investigations has been carried out during the present year by the staff of the Institution for Research in Animal Nutrition of the University of Leeds, assisted by members of the staff of the agricultural department of the University. These investigations have dealt primarily with matters of direct practical interest and the more immediately useful results are summarised in the present report.

The use of palm kernel cake in this country dates back to the middle of last century, and this earlier experience had left a tradition that the cake was not very palatable to stock and deteriorated rapidly in storage.

These are serious defects in any food, and, if actually inherent in palm kernel cake, must almost preclude any great extension of its use. It was thus clearly desirable to have these matters submitted to strict experimental investigation

It was further thought desirable to determine the degree of digestibility of the cake. The opinion of practical men, based largely upon the unattractive "grittiness" of the cake, probably inclines mainly to the view that it is not very digestible. This is quite at variance with the results of actual determinations of digestibility made in the past at German

experiment stations. Only one such set of determinations has been made in recent years, however, and in view of this paucity of information and of the improvements in the manufacture of the cake, further determinations were obviously desirable.

The investigations included also a test on a small scale of the influence of palm kernel cake upon the secretion of milk, with special reference to the yield and character of the fat of the milk.

The results obtained under these various heads are summarised in separate sections in the following pages. At the head of each section the member of the staff responsible for the work summarised is indicated.

The whole of the practical work with stock was carried out at Manor Farm, Garforth (Experimental Farm of the University of Leeds and the Yorkshire Council for Agricultural Education), and was in the experienced hands of Mr. H. J. Hargraves, N.D.A.

PALATABILITY.

(*H. J. Hargraves, N.D.A.*)

The general experience of the past two years in different parts of the country has indicated clearly that palm kernel cake is at the outset not so readily consumed by stock as many other concentrated foods in common use. Previous experience with the cake at Garforth showed considerable variation in this respect with cattle, but a uniform difficulty with sheep. In no case, however, did the difficulty prove more than temporary.

In the present series of tests the assumption was made at the outset that this difficulty was associated with the flavour or aroma of the cake. In the first place, therefore, the possibility of a modification of the process of manufacture or of a treatment of the cake to remove the supposed objectionable ingredients was considered. In this connection and throughout the whole of the palatability tests we received the greatest assistance from the Olympia Oil and Cake Co., Ltd., through the Managing Director, L. C. Paget, Esq., to whom we are greatly indebted for helpful suggestions and material assistance.

Steaming and other methods of treating the kernels to render the cake more appetising were considered but found impracticable, and as yet we have found no solution of the problem of producing a pure palm kernel cake which shall be as directly attractive to stock as, say, linseed cake.

Attention was next directed, therefore, to the possibility of rendering the cake more appetising by admixture of substances of attractive aroma or flavour. Through the kindness

of Mr. Paget special cakes were prepared containing small proportions of molasses, fenugreek, locust bean meal and linseed cake respectively. These cakes were carefully tested with cows both by noting the time required to consume a given quantity and by giving each cow a simultaneous choice of two of the cakes and noting the individual preferences.

On the whole the cake flavoured with locust bean meal seemed to be the most acceptable but the differences were very slight and ill-defined.

In the course of these tests it very soon became obvious that the reluctance of the cattle to eat ordinary palm kernel cake was not due to any defect of aroma or flavour, but to physical difficulty of mastication and swallowing. This difficulty was always noticeable when the cows were first put on palm kernel cake. With very few exceptions they did not refuse the cake, but after a few mouthfuls an interval for mastication became necessary, saliva flowed profusely and the swallowing of the food often led to a violent round of coughing. After a few such experiences the cow would learn to eat the cake more cautiously and with less obvious signs of difficulty. The time required for consumption of the cake, however, was always much longer than was required for an equal weight of linseed cake or soya cake.

The difficulty is undoubtedly associated with the characteristic "grittiness" of the cake. Although freshly-made palm kernel cake absorbs considerable quantities of moisture from the air on storage, and acquires a crumbly character, its particles never lose their hard, gritty feel in the mouth. This is the case even after prolonged soaking in water, and tests showed that the above-named difficulty could not be removed in this way.

It must be admitted, therefore, that if used as the sole cake-food of cows and sheep, palm kernel cake will require greater patience on the part of the stockman to secure adequate consumption than other cakes demand. If patience be exercised, however, the difficulties soon vanish, and we have never failed with either cows or sheep to secure perfectly satisfactory consumption.

The difficulties are naturally less when the cake is fed in admixture with other foods. Numerous tests were made with mixtures in varying proportions of palm kernel cake with linseed cake, soya cake, "soycot" cake and locust bean meal respectively. The results in each series were substantially the same, and may be illustrated by the appended series of tests of mixtures with linseed cake :—

Composition of Mixture.

Palm Kernel Cake. *Parts.*		*Linseed Cake.* *Parts.*		*Time required for Complete Consumption.* *Mins.*
4	....	0	....	23–25
3	....	1	....	18–20
2	....	1	....	14–18
1	....	1	....	14–17
1	....	2	....	10–12
1	....	3	....	10–14
0	....	4	....	8–9

The total weight of mixture supplied per cow was 6 lb. in each case. It will be noted that the cows required practically three times as long to consume 6 lb. palm kernel cake as to consume the same weight of linseed cake.

In every case the difficulty of mastication associated with palm kernel cake was perceptible, and consumption was relatively slow if this cake formed appreciably more than one-third of the total mixture.

The general conclusion from the whole of these tests must, therefore, be that whilst palm kernel cake is not actually distasteful to stock its physical character does give rise to certain initial difficulties in securing satisfactory consumption. These difficulties are not immediately removed by soaking the cake in water or by flavouring it with fenugreek or molasses. They become quickly less pronounced as the animal gets accustomed to the cake, and are of no practical consequence where the cake is fed in admixture with at least twice its weight of other cake or meal. The difficulties are greater with sheep than with cows, but in either case with the exercise of a little patience and ingenuity a perfectly satisfactory consumption can be attained.

KEEPING PROPERTIES.

(*W. Godden, B.Sc., A.R.C.S., F.I.C.*)

In order to obtain guidance as to the keeping properties of palm kernel cake comparative tests have been made both in the laboratory and at the farm.

In the laboratory tests the conditions of storage were intentionally made such as would represent very bad conditions of storage on the farm, but in the tests made at the farm the cakes were stored in the cake-house along with the general supplies of the farm under conditions which have been found quite satisfactory in practice.

In these tests palm kernel cake was compared with six other kinds of cake, viz., linseed, soya, cottonseed, " soycot," groundnut, and coconut cakes. In each case, through the kindness of

the Olympia Oil and Cake Company, four adjacent cakes from the middle of a press were obtained fresh from the mill. Of these, two were stored at the Manor Farm, Garforth, being stacked in the ordinary way along with the rest of the cake supply of the farm. The other two cakes were retained for the laboratory tests.

In the tests attention was directed to the more obvious signs of change during storage, such as appearance, smell, development of mould, etc., but more especially to the following points :—

(*a*) Any changes in the proportions of protein (albuminoids) and oil in the cake.

(*b*) Any development of "amides" during storage, such being indicative of decomposition of protein.

(*c*) The increase in the amount of free fatty acids in the oil during storage, this being indicative of decomposition of the oil.

(*d*) The part played by the oil in any changes undergone by the nitrogenous ingredients.

The detailed results of these tests need not be given here : it will suffice for our present purpose to indicate their general character.

In both the laboratory and farm tests the palm kernel cake proved itself on the whole to be quite equal in keeping properties to the other cakes used. Under the severe conditions of storage adopted in the laboratory, where the finely-ground cake was stored in a damp condition in a badly-ventilated vessel kept continuously warm (99° F.), the palm kernel cake certainly became very rancid within three weeks, but so did also all the other cakes without exception. In these tests the first cake to show mould was "soycot," followed closely by cottonseed, ground-nut and soya cakes. Linseed cake showed slight signs of mould after three weeks, but palm kernel cake and coconut cake did not develop mould at all. The outstanding feature with regard to the palm kernel cake was the extent to which decomposition of the oil with production of free fatty acids took place. This change was very pronounced, but little more so than in the case of soya cake, and, indeed, less so than in the case of ground-nut and coconut cakes.

In the case of the cakes stored at the farm, samples were taken after three months' and after six months' storage, covering the whole of the summer. With the possible exception of coconut cake the cakes showed no appreciable change in percentage composition at the end of six months (see table below)nor were there any marked external signs of deterioration.

It was found, however, in every case that the proportion of free fatty acids present in the oil of the cakes had increased considerably, the initial and final values being as follows :—

—	Percentage of Oil in Cake (expressed as percentage of dry matter).		Free Fatty Acids in Oil of Cake (expressed as percentage of oleic acid).	
	Initial.	After 6 months' Storage.	Initial.	After 6 months' Storage.
	Per cent.	Per cent.	Per cent.	Per cent.
Und. cottonseed cake	5·33	5·47	61·48	87·44
"Soycot" cake ..	6·01	5·85	20·95	65·33
Ground-nut cake ..	11·27	10·25	14·65	56·02
Linseed cake	13·43	14·02	11·23	29·82
Coconut cake ..	15·59	12·55	5·84	73·45
Palm kernel cake ..	10·38	10·76	5·70	40·93
Soya cake	6·61	7·22	5·18	16·37

The most striking feature of these data is the high initial acidity in the case of cottonseed cake. This was undoubtedly attributable to the notoriously bad quality of the 1915 crop of cottonseed, and the figures, therefore, cannot be taken as typical of good cottonseed cake. The high initial acidity of the "soycot" cake finds a similar explanation. The final acidities are all high, even the lowest (soya cake) being more than three times the original value. The relative increase, apart from the abnormal case of cottonseed cake, is lowest in the case of linseed cake and highest in the case of coconut cake. If this final free acidity be taken as the criterion of the degree of rancidity of the cakes, then palm kernel cake was surpassed in keeping properties only by soya cake and linseed cake.

It is difficult to say just what practical significance should be attributed to this increase in acidity. The presence of appreciable quantities of free fatty acids in a feeding-stuff is commonly regarded as undesirable, but, provided the acidity be not so high as to cause actual derangement of the digestive functions, it is at least doubtful whether the nutritive value of the oil is seriously lowered by this liberation of the fatty acids present in it. In any case, as the above data indicate, it is common to the oil-containing feeding-stuffs and cannot be adduced as a specific objection against the extended use of palm kernel cake.

The general conclusion from the tests here outlined is that, so far as keeping properties are concerned, palm kernel cake

compares favourably with most of the oil-cakes commonly used on the farm.

DIGESTIBILITY.

(*H. E. Woodman, M.Sc., Ph.D.*)

Information as to the digestibility of palm kernel cake and meal has, up to the present, been limited to the results of three series of determinations made in Germany, of which two were carried out more than forty years ago.

During the past summer experiments have been carried out at Garforth with two consignments of palm kernel cake and one of extracted palm kernel meal. Two sheep were used for the purpose, and separate determinations of digestibility made with each animal. Each experimental period consisted of twelve days, throughout which an accurate record of food consumed and fæces excreted was obtained. Between each experimental period a transitional period of nine days was interposed, in the first three days of which the necessary readjustment of the food-supply was effected.

In a further period of the experiment the digestibility of a sample of undecorticated cottonseed cake (Egyptian) was determined in precisely similar fashion. This feeding-stuff resembles palm kernel cake in general chemical composition more closely than any other oil-cake in common use, so that it was obviously of interest to compare the digestibility of each.

It is not proposed to give here more than a summary of the results obtained, but it may be remarked that the results obtained with the individual sheep were reasonably concordant for work of this character.

Taking in each case the averages for the two sheep the results were as follows :—

	Percentage Digestibility.		
	Palm Kernel Cake. Per cent.	*Extracted Palm Kernel Meal. Per cent.*	*Undecorticated Cottonseed Cake. Per cent.*
Total dry matter	74·2	75·5	57·7
Organic matter	75·9	76·7	58·0
Crude protein (crude albuminoids)	91·0	90·0	74·7
True protein (true albuminoids)	90·9	89·7	72·0
Oil	97·5	96·4	(100·0 ?)
Nitrogen-free extractives (soluble carbohydrates)	83·1	86·0	62·0
Crude fibre	37·1	44·8	34·9

It will be noted that the palm kernel cake and meal each showed a high degree of digestibility, and were markedly superior in this respect to the cottonseed cake. The differences shown between the palm kernel cake and palm kernel meal are

such as must be regarded as negligible in work of this character. It would not be safe, for example, to assert that the crude fibre is generally more digestible in the extracted meal than in the cake, since the individual results upon which the foregoing averages are based vary between wide limits. This is almost invariably the case in determinations of the digestibility of crude fibre in feeding-stuffs. Incidentally it may be remarked that the results lend little support to the claim advanced in some quarters that the crude fibre of palm kernel cake and meal is more digestible than that of other oil-cakes.

The determination of digestibility is affected by certain errors which tend to lower the results. This is particularly the case with the protein and oil. For the former it is possible to devise a correction, and this has been done in the case of the results given above. In the case of the oil, however, no satisfactory method of correction has been devised, so that the results quoted may be regarded as an underestimate of the digestibility of the oil. The indicated digestibility of the oil of the cottonseed cake actually exceeded 100 per cent., a result which can only be interpreted as indicating that only the merest traces, if any, of the cottonseed oil can have escaped digestion. It was thus only with respect to this ingredient that the cottonseed cake proved equal to the palm kernel cake or meal.

The average composition of the feeding-stuffs used was as follows :—

	Palm Kernel Cake. *Per cent.*	*Extracted Palm Kernel Meal.* *Per cent.*	*Undecorticated Cottonseed Cake.* *Per cent.*
Moisture	11·29	11·57	11·61
*Crude protein ("albuminoids")	17·78	18·78	22·25
Oil	8·68	2·06	4·69
Nitrogen-free extractives ("carbohydrates")	44·50	47·31	33·38
Crude fibre	14·11	16·43	22·75
†Ash	3·64	3·85	5·35
*Including true protein	17·45	18·19	20·10
†Including sand	0·48	0·58	0·27

Applying now the respective digestibilities as found by experiment the proportions of digestible nutrients in the feeding-stuffs work out as follows :—

	Palm Kernel Cake. *Per cent.*	*Extracted Palm Kernel Meal.* *Per cent.*	*Undecorticated Cottonseed Cake.* *Per cent.*
*Crude protein	16·18	16·90	16·62
Oil	8·46	1·99	4·55 (estimated)
Nitrogen-free extractives	36·98	40·69	20·70
Crude fibre	5·24	7·36	7·94
*Including true protein	15·86	16·32	14·47

From these figures we can now calculate the "food units" per ton, using the conventional expression :—

Food Units = (Digest. Protein + Digest. Oil) × $2\frac{1}{2}$ + Digest. Carbohydrates + Digest. Fibre.

The result is as follows :—

Palm kernel cake	103·0 food units.
Extracted palm kernel meal.. ..	93·8 ,,
Undecorticated cottonseed cake ..	76·2 ,,

In other words the palm kernel meal may be regarded as worth 23 per cent. more per ton, and the palm kernel cake 35 per cent. more per ton, than the cottonseed cake. It must be remembered that these comparative values refer only to the actual materials used in the digestibility experiments, and must not be treated as averages for the foods in question.

THE INFLUENCE OF PALM KERNEL CAKE UPON THE YIELD AND COMPOSITION OF MILK.

(*A. G. Ruston B.A., B.Sc.*)

In a recent issue of this *Journal** a summary was given of the numerous investigations, mainly Continental, which have been made of the influence of the feeding of palm kernel cake to cows upon the yield and composition of the milk produced by them. This summary indicated that a good deal of sound experimental evidence can be adduced in favour of the claim that palm kernel cake, although it may not greatly affect the total flow of milk, may appreciably increase the secretion of fat in the milk.

This evidence is entirely limited, however, to experiments carried out in Germany, and as yet no clear evidence has been obtained that these effects can be reproduced with dairy cattle in this country. This divergence is possibly significant, since the average percentage of fat in the milk of the common German dairy breeds is appreciably lower than that of our commonest breed, the Shorthorn. The experimental work done in this country, however, is at present too meagre to furnish a decisive answer, and as the point is one of obvious practical importance it merits further investigation.

The question was the subject of a preliminary experiment on a small scale at Garforth in the spring of 1915, two groups of four cows each being used for the purpose. The results indicated a slight increase in the secretion of milk and of fat through the substitution of palm kernel cake for undecorticated

* Vol. xxiii., July, 1916, p. 305.

cottonseed cake, but the latter increase was barely outside the region of probable error and could hardly be regarded as significant.

In the summer of the present year a further test has been made upon quite different lines. Only a few cows in suitable condition for the experiment were available, so that it was not feasible to carry out the test as before with two groups. The method of experiment adopted was consequently what is commonly described as the "period system," all the cows receiving identical feeding which varied from period to period. Five cows were selected for the purpose, and for three weeks (Period I., 5th–26th June) were fed on pasture alone, without cake or other added food. Palm kernel cake was then introduced gradually during a transitional period of one week, after which the diet of pasture and cake was continued for three weeks (Period II., 3rd–24th July). During a further transitional week the cake was withdrawn, and the cows kept subsequently for three weeks more (Period III., 1st–22nd August) on pasture alone.

The feeding in Periods I. and III. was thus identical, and the results obtained in these periods furnished a guide to the normal changes in the yield and quality of the milk with advance of lactation.

In other words, this method of experiment—which has been largely used in the study of milk secretion—is based upon the assumption that the average results of Periods I. and III., in which the feeding was identical, represent the results which would have been obtained as the average for Period II. had the feeding in this period been identical with that of Periods I. and III.

The experiment proceeded quite smoothly, with the rather unfortunate exception that, owing to the abundant pasturage, the animals could not be induced to eat more than 2–3 lb. per head per day of the palm kernel cake.

The milk of each cow was weighed at each milking, and on five days weekly a sample was taken of each cow's milk at each milking for the determination of total solids and fat. From these individual samples a mixed sample representative of the day's output was made up each day and subjected to more complete analysis. The results of the experiment are summarised in the table at the top of p. 744.

It will be observed that three cows show an increase in yield of milk, ostensibly due to the palm kernel cake, whilst of the remaining two, one shows no change and the other a slight

No. of Cow.	Yield of Milk.			Per cent. of Fat.			Yield of Fat.		
	Daily Average for Period II.	Mean for Periods I. and III.	Increase (+) or Decrease (—)	Daily Average for Period II.	Mean for Periods I. and III.	Increase (+) or Decrease (—)	Daily Average for Period II.	Mean for Periods I. and III.	Increase (+) or Decrease (—)
	lb.	lb.	lb.	Per cent.	Per cent.	Per cent.	lb.	lb.	lb.
2 *a* 3	16·8	17·4	— 0·6	4·17	4·22	— 0·05	0·70	0·71	— 0·01
12 *b* 1	24·7	24·7	0·0	3·87	3·70	+ 0·17	0·96	0·91	+ 0·05
21	27·0	26·2	+ 0·8	3·88	3·91	— 0·03	1·05	1·02	+ 0·03
23	25·9	24·0	+ 1·9	3·77	3·63	+ 0·14	0·98	0·87	+ 0·11
24	22·3	22·1	+ 0·2	4·27	4·06	+ 0·21	0·95	0·90	+ 0·05
Average	23·34	22·88	+ 0·46	3·99	3·90	+ 0·09	0·93	0·88	+ 0·05

decrease, the average of all representing an increase of practically ½ lb. of milk per cow per day. In percentage of fat three cows show an appreciable rise and two a slight decrease, the difference on the average being a rise of 0.09 per cent. The effects on yield of fat represent of course the combined effects on yield of milk and percentage of fat, one cow (No. 23) showing an appreciable increase, three cows a slight increase, and the remaining cow a slight decrease in output of milk-fat, the average result being an increase of 0·05 lb., or roughly one-eighteenth of the average yield of fat per cow.

The results with reference to the solids-not-fat of the milk are given below :—

No. of Cow.	Per cent. in Milk.			Total Yield.		
	Daily Average of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)	Daily Average of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)
	Per cent.	Per cent.	Per cent.	lb.	lb.	lb.
2 *a* 3	8·45	8·55	— 0·10	1·42	1·49	— 0·07
12 *b* 1	8·45	8·68	— 0·23	2·09	2·14	— 0·05
21	8·25	8·20	+ 0·05	2·23	2·15	+ 0·08
23	8·46	8·57	— 0·11	2·19	2·06	+ 0·13
24	8·68	8·79	— 0·11	1·94	1·94	— 0·00
Average..	8·46	8·56	— 0·10	1·97	1·95	+ 0·02

The table shows a practically uniform decrease in the percentage of solids-not-fat, but it is doubtful whether this was due so much to the use of palm kernel cake as to the deterioration of the pasture during the later stages of the experiment. The commonly experienced deterioration of the pastures in August and September is not infrequently accompanied by a

marked fall in the proportion of solids-not-fat in the milk of the cows grazing them.

The data obtained with the daily composite samples of milk which were submitted to more detailed analysis are summarised below :—

—	Per cent. in Milk.			Total Yield.		
	Daily Average of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)	Daily Average of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)
	Per cent.	Per cent.	Per cent.	lb.	lb.	lb.
Milk	—	—	—	23·34	22·88	+ 0·5
Total solids ..	12·48	12·46	+ 0·02	2·91	2·85	+ 0·06
Fat	3·98	3·95	+ 0·03	0·93	0·90	+ 0·03
Solids-not-Fat .	8·50	8·51	— 0·01	1·98	1·95	+ 0·03
Protein ..	3·17	3·15	+ 0·02	0·74	0·72	+ 0·02
Lactose (sugar)	4·60	4·71	— 0·11	1·07	1·08	+ 0·01
Ash	0·73	0·70	+ 0·03	0·17	0·16	+ 0·01

The indicated changes in composition are, with the exception of the lactose, very slight. It must be admitted, indeed, that throughout the tables the differences indicated as presumably due to the use of palm kernel cake are in most cases little, if at all, outside the region of probable error of experimental work on this scale and hardly of real practical significance. An exception must be made, however, of the case of the percentage of fat, the three increases shown (table on p. 744) being quite substantial, whilst the two decreases are within the limits of error. This lack of uniformity is not surprising, since it is to be expected that the factor of individuality will play a part in determining changes such as those under consideration, some cows showing a marked response whilst others are indifferent.

It has been suggested that if palm kernel cake has the specific stimulating effect on fat-secretion that is claimed for it a means is afforded of raising the low fat-content of morning milk which is so often a source of trouble in the summer months. It is of interest, therefore, to compare the records of the morning and evening samples in the Garforth experiment as summarised in the table at the top of page 746.

It will be seen that the effect of the palm kernel cake was much more pronounced in the evening milk than in the morning milk, only one cow showing a measurable improvement in the latter. This phenomenon may arise partially from the very unequal milking intervals, the cows being milked daily at

No. of Cow.	*Morning Milk.*			*Evening Milk.*		
	Daily Average Fat per cent. of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)	Daily Average Fat per cent. of Period II.	Mean of Periods I. and III.	Increase (+) or Decrease (—)
2 *a* 3	3·76	3·73	+ 0·03	4·90	4·94	— 0·04
12 *b* 1	3·17	3·20	— 0·03	4·84	4·42	+ 0·42
21	3·31	3·28	+ 0·03	4·66	4·74	— 0·08
23	3·28	3·24	+ 0·04	4·43	4·19	+ 0·24
24	3·65	3·54	+ 0·11	5·08	4·76	+ 0·32
Average ..	3·43	3·40	+ 0·03	4·78	4·61	+ 0·17
Mixed Milk of 5 Cows ..	3·40	3·34	+ 0·06	4·78	4·56	+ 0·22

6.30 a.m. and 3.30 p.m. Unfortunately, however, it is under just such conditions that the difficulties with the quality of the morning milk arise.

It is difficult in work on this scale to know how far the actual results recorded can be taken as an accurate index of the effects of the change of feeding under investigation, but from a careful analysis of the records we are led to the opinion that in the case of at least three of the cows there was in Period II. a real increase in yield of milk and of fat leading to a slight enrichment of the milk in the latter. It is legitimate to suggest that this improvement may have been due to the increased food-supply in Period II., and this doubtless was the cause of the slight increase in yield of milk, but previous experience at Garforth in feeding other kinds of cake to cows at pasture in the summer months makes it seem very doubtful whether the improvement in quality of the milk can have been due to this cause. The most pronounced effect of the supply of cake in Period II. was produced upon the live-weights of the animals as shown by the weighings made at the end of each period. During Period II. each cow gained weight, the individual increases ranging from 18 lb. to 88 lb., whereas during the following period when no cake was fed the live-weights either remained practically stationary or fell appreciably.

INFLUENCE UPON COMPOSITION OF BUTTER-FAT.

(*H. Woodhouse, M.A., B.Sc.*)

In order to obtain information as to the influence of palm kernel cake upon the actual character of the butter-fat secreted

by cows fed upon it, samples of butter were prepared twice weekly from the milk of two of the cows (Nos. 21 and 23) used in the experiment described above. In each case the butter represented the mixed morning and evening produce of the cow for the day. The samples were prepared and analysed with the least possible delay, the analysis in every case being performed upon the dry, filtered fat.

With each sample the following determinations were made :—

(1) *Kœttstorfer Number* (*i.e.*, the number of milligrammes of potassium hydrate required for the saponification of one gramme of the fat).
(2) *Reichert-Wollny Number* (*i.e.*, the number of cubic centimetres of decinormal soda solution required to neutralise the total *soluble* acids volatile in steam that are contained in free or combined state in 5 gms. of the fat).
(3) *Polenske Number* (*i.e.*, the number for the *insoluble* volatile acids corresponding to the Reichert-Wollny Number for the soluble volatile acids).
(4) *Iodine Number* (*i.e.*, the number of grammes of iodine that can be taken up by 100 gms. of the fat).
(5) *Refractive Index*.

The basal idea of this examination of the fat was to ascertain whether the oil of the palm kernel cake had any tendency to impart its characteristics to the butter-fat, or, in other words, to change the character of the latter in the same way as a direct admixture of palm kernel oil with the pure butter.

Without going into a detailed explanation as to the precise significance of each of the above-named criteria, it may be stated that any such admixture of palm kernel oil with the butter-fat would lower the Reichert-Wollny Number, the Iodine Number and the Refractive Index, and would raise the Polenske Number and the Koettstorfer Number.

The averages for each period of the experiment are set out in the table at the top of p. 748.

It will be observed that in every case the results furnish evidence of an appreciable influence of the palm kernel cake upon the composition of the butter-fat. Except that the Reichert-Wollny Number is raised rather than lowered the changes are just such as an admixture of a little palm kernel oil with the butter-fat would produce. The raising of the Reichert-Wollny Number, however, probably signifies that it is only certain of the constituent acids of the palm kernel oil that have passed into the milk-fat and not the palm kernel oil as a whole. This is further suggested by the relatively large increase in the Polenske Number.

—	Koett-storfer Number.	Reichert-Wollny Number.	Polenske Number.	Iodine Number.	Index of Refraction at 40°C.
		Cow No. 21.			
Period I. ..	229·2	31·9	2·50	40·3	1·4522
,, II. ..	231·1	30·3	2·14	36·3	1·4510
,, III. ..	223·5	27·8	1·26	39·5	1·4524
Average of Periods I. & III.	226·3	29·8	1·88	39·9	1·4523
Increase (+) or Decrease (—) due to cake ..	+ 4·8	+ 0·5	+ 0·26	— 3·6	— 0·0013
		Cow No. 23.			
Period I. ..	228·4	31·0	2·55	41·7	1·4523
,, II. ..	230·1	30·0	2·47	37·6	1·4513
,, III. ..	222·5	25·6	1·24	42·7	1·4529
Average of Periods I. & III.	225·4	28·3	1·90	42·2	1·4526
Increase (+) or Decrease (—) due to cake ..	+ 4·7	+ 1·7	+ 0·57	— 4·6	— 0·0313

These results furnish clear evidence that the palm kernel cake fed in Period II. did exercise an appreciable effect upon the fat secretion, and render more probable the conclusion that the apparent effects upon the output of fat attributed in the preceding section to the cake was real and definitely attributable thereto.

SUMMARY.

1. *Palatability.*—(*a*) The initial difficulty of securing a satisfactory consumption of palm kernel cake by cattle or sheep is due less to unattractive flavour or aroma than to physical difficulties of mastication and swallowing, which arise probably from the characteristic "grittiness" of the cake. With reasonable care in introducing the cake into rations this difficulty soon ceases to be of practical significance, although the rate of consumption is much slower than with other commonly used cakes.

(*b*) The difficulty cannot be avoided by moistening the cake or by admixture of relatively small quantities of molasses, "spices" or other appetising ingredients. It becomes insignificant, however, if the cake be mixed with other foods in amounts such that the palm kernel cake does not form more than one-third to one-half of the total mixture.

2. *Keeping Properties.*—(*a*) Palm kernel cake has been kept alongside other cakes in the farm store for six months and showed neither in outward characteristics nor in composition any sign of deterioration that was not equally marked in the other cakes, with the exception of linseed cake and possibly soya cake.

(*b*) In laboratory tests in which the conditions of storage were made as unfavourable as possible the palm kernel cake did not go mouldy but, in common with the other cakes tested, showed considerable decomposition of the oil. A rise in the acidity of the oil during storage is common to all oil-cakes.

3. *Digestibility.*—(*a*) The direct determination of the digestibility of palm kernel cake and extracted meal in an experiment with two sheep showed these foods to be very satisfactory in this respect. They must rank amongst the most digestible foods at the farmer's disposal.

(*b*) Estimates based upon the results of thé experiments indicate that the palm kernel cake used was worth 35 per cent. more, and the extracted palm kernel meal 23 per cent. more than the Egyptian undecorticated cotton seed cake used.

4. *Influence upon Milk Secretion.*—(*a*) In a small-scale experiment with five cows indications were obtained of a specific favourable influence of palm kernel cake upon the production of milk-fat, leading to a slight increase in the fat-content of the milk.

(*b*) This increase was more marked in the evening milk than in the morning milk.

(*c*) The magnitude of the increase varied greatly with the individual cows and in some cases was within the range of probable error.

5. *Influence upon Character of Milk-Fat.*—The examination of samples of fat prepared twice weekly from two of the cows used for the experiment referred to under (4) demonstrated that the feeding of palm kernel cake exercised an effect upon the composition of the milk-fat such as might be obtained by passage of some ingredients of the palm kernel oil into the milk-fat.

THE CONTROL OF AMERICAN GOOSEBERRY MILDEW BY SPRAYING.

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DURING the past two or three years, careful observations of the fruit plantations of the Eastern Counties have shown that the American Gooseberry Mildew (*Sphærotheca Mors-uvæ*) has been reduced and in some cases almost stamped out by growers who have subjected their bushes to a thorough "tipping" (*i.e.*, cutting off the diseased shoots and burning them), followed by a thorough spraying with lime-sulphur solution two or three times during the growing season.

The writers undertook the following experiments to ascertain the extent to which the disease could be reduced in a single season by spraying at various intervals.

Numerous experiments were carried out by Brooks, Petherbridge and Spinks* in the season of 1913-1914, and it was then concluded that lime-sulphur checked the development of the disease only to a slight extent, negligible from a commercial standpoint. It should, however, be mentioned that in the spring of 1914 the attack of American Gooseberry Mildew was very severe, commencing as early as 6th April, while the final spraying previous to the pulling of the fruit was done as early as the end of April.

The following experiments were carried out on the same plots as those mentioned above, the numbers of the plots corresponding. The bushes under experiment were of the variety "Whinham's Industry," and varied in age from 1 to 16 years.

Each plot contained about ten rows of gooseberries with plum and apple trees in every third row. The area of every plot was rather less than half an acre—increasing slightly from Plot 12 to Plot 21. As will be seen below, Plot 22, a much larger one than any of the others, was divided into three parts, and the parts treated differently.

* *Journal*, June, 1915, p. 227.

The greater part of this plantation has been devoted to experimental work for some years, and American Gooseberry Mildew has to a certain extent been deliberately encouraged. The plantation has, consequently, suffered severely from the disease. In 1915 it was one of the most badly infected premises in the Eastern Counties.

In the season devoted to the experiments now being described, "tipping" began on 25th August, 1915, at Plot 21, and proceeded at the rate of about one plot per day until Plot 12 was reached on 8th September. Plots 22 A, B, and C were not "tipped" at all. Spraying was commenced in the first week in April, 1916, and was repeated at intervals of three or four weeks, as shown by the full details appended below :—

Plot 12.—Tipped, 8th September.
Sprayed with lime-sulphur,* 6th April, 5th May, 1st June, 30th June.

,, 13.—Tipped, 7th September.
Sprayed with lime-sulphur, 6th April, 27th April, 18th May.

,, 14.—Tipped, 6th September.
Not sprayed.

,, 15.—Tipped, 3rd September.
Not sprayed.

,, 16.—Tipped, 1st September.
Sprayed with lime-sulphur, 6th April, 5th May, 1st June. (In this plot the spray fluid was directed downwards on the leaves, and not upwards as in the other plots).

,, 17A.—Tipped, 31st August.
Sprayed with lime-sulphur, 7th April, 5th May, 2nd June.

,, 17B.—Tipped, 31st August.
Sprayed with lime-sulphur, 7th April, 5th May.
Sprayed with soft soap and ammonium sulphide†, 2nd June.

,, 18.—Tipped, 30th August.
Sprayed with lime-sulphur, 7th April, 18th May.

,, 19.—Tipped, 27th August.
Sprayed with lime-sulphur, 7th April, 5th May.

,, 20.—Tipped, 26th August.
Sprayed with lime-sulphur, 7th April.

,, 21.—Tipped, 25th August.
Not sprayed.

,, 22A.—Not tipped.
Sprayed with lime-sulphur, 8th April, 6th May, 1st June.

* In every case 1 gal. of lime-sulphur to 40 gal. of water.

† Soft soap 2 lb., ammonium sulphide 1 gal., water 19 gal., as recommended by Eyre and Salmon. *Journal*, February, 1916, p. 1118.

Plot 22B.—Not tipped.
Sprayed with lime-sulphur, 6th May.
„ 22C.—Not tipped.
Not sprayed.

The spraying was done by Messrs. Chivers & Sons' spraying staff under the writers' supervision. Great care was taken to cover thoroughly the under surfaces of the leaves, and also those shoots in the centre of the bushes, so often missed in the average spraying. For this purpose swivel nozzles, set to spray almost vertically, were used. The hand pump used gave a pressure of about 60 lb. to the square inch.

The amount of spray fluid applied per acre was about 240 gal. at each application, more spray being naturally required in the later sprayings than in the earlier ones. Plot 16 was sprayed only on the upper surfaces of the leaves; nevertheless about 180 gal. per acre were applied.

The weather conditions were very good for spraying, very little wind or rain being experienced.

The disease was first noticed on 6th May on Plot 15 and on different parts of Plot 22. In a few days it was found on all the plots which had not been sprayed.

The following system of estimation always adopted in returns made by officers of the Board of Agriculture and Fisheries has been used in connection with the present experiments:—

Percentage.	1—20 per cent.	21—40 per cent.	41—60 per cent.	61—80 per cent.	81—100 per cent.
i. Extent or percentage of bushes affected (both as regards (A) berries and (B) shoots.	v.f. (very few)	f. (few)	c. (common)	m. (many)	v.m. (very many)
ii. *Intensity or average* percentage of infectible tissue ((A) berries (B) shoots infected).	v.s. (very slight)	s. (slight)	g. (general)	b. (bad)	v.b. (very bad)

Less than one per cent. is generally returned as a trace.

The first table on p. 753 gives the observations on the state of the plots at various dates.

The berries were picked from 22nd June to 27th June, and the total weight of berries on each plot was taken In order to arrive at the proportion of mildewed to healthy fruit a basketful from each row was sorted, and the mildewed and healthy berries were weighed separately.

State of the Plots at various Dates.

No. of Plot.	May 9th. On the Berries. (A)	May 26th. On the Berries. (A)	June 21st. On the Berries. (A)	June 21st. On the Shoots. (B)	Sept. 21st. On the Shoots. (B)
12	0	trace	trace	0	trace
13	0	0	trace	0	m. : v.s.
14	trace	v.m. : s. to g.	v.m. : g. to b.	v.m. : s	v.m. : b.
15	trace	v.m. : s. to g.	v.m. : b.	v.m. : s.	v.m. : b.
16	0	scattered traces	v.f. : v.s.	0	m. : v.s.
17A	0	0	trace	0	c. : v.s.
17B	0	0	trace	0	c. : v.s.
18	0	trace	scattered traces	0	m. : v.s.
19	0	trace	scattered traces	0	m. : v.s.
20	0	v.f. : v.s.	v.m. : v.s.	traces	v.m. : g.
21	trace	v.m. : s. to g.	v.m. : b.	v.m. : s.	v.m. : b.
22A	0	trace	trace	0	m. : v.s.
22B	0	trace	v.m. : v.s.	0	m. : v.s.
22C	trace	v.m. : s. to g.	v.m. : b.	v.m. : s.	v.m. : b.

The following table shows the weight of mildewed and healthy fruit on each of the plots :—

Weight of Fruit.

No. of Plot.	No. of Rows in Plot.	Date of Tipping.	No. of times Sprayed before Picking.	Dates of Spraying.	Weight of Fruit. Mildewed.		Healthy.		Total.		Mildewed.
					st.	lb.	st.	lb.	st.	lb.	Per cent.
12	10 rows	Sept. 8th ..	3	1. Apl. 6th .. 2. May 5th .. 3. June 1st ..	0	5	73	0	73	5	0·5
13	10 ,,	,, 7th ..	3	1. Apl. 6th .. 2. Apl. 27th .. 3. May 18th ..	0	3¾	52	9	52	12¾	0·5
14	10 ,,	,, 6th ..	0	——	14	11	15	0	29	11	49·6
15	10 ,,	,, 3rd ..	0	——	22	10	18	10	41	6	54·8
16	10 ,,	,, 1st ..	3	1. Apl. 6th .. 2. May 5th .. 3. June 1st ..	1	3	58	2	59	5	2·0
17A	5 ,,	Aug. 31st ..	3	1. Apl. 7th .. 2. May 5th .. 3. June 2nd ..	0	1½	30	1½	30	3	0·4
17B	5	,, 31st ..	3*	1. Apl. 7th .. 2. May 5th .. 3. June 2nd ..	0	3	38	9	38	12	0·6
18	10 ,,	,, 30th ..	2	1. Apl. 7th .. 2. May 18th ..	1	0½	68	10½	69	11	1·5
19	10 ,,	,, 27th ..	2	1. Apl. 7th .. 2. May 5th ..	0	10½	71	10	72	6½	1·0
20	10 ,,	,, 26th ..	1†	1. Apl. 7th & 8th.	19	5	71	0	90	5	21·4
21	10 ,,	,, 25th ..	0	——	32	10	26	12	59	8	54·9
22A	8 ,,	Not tipped ..	3	1. Apl. 8th .. 2. May 6th .. 3. June 1st ..	0	7½	86	1	86	8½	0·6
22B	7 ,,	,, ..	1‡	1. May 6th ..	2	2	82	2	84	4	2·5
22C	10 ,,	,, ..	0	——	35	0	23	7	58	7	59·8

* See remarks above as to Plot 17B.
† Apparently too early for this season's condition.
‡ Apparently the better time this season for a single spraying.

It has been mentioned above that all the plots were approximately of the same area, but the proportion of large to small bushes varied considerably. This variation would account to some extent for the different total yields of the plots, but not sufficiently for the marked difference between the average total yields of the plots sprayed two or more times (viz., 72 stones) and that of the unsprayed plots (viz., 47½ stones). It is possible that the water applied in spraying was an important factor in increasing the yield, but it should also be remembered that berries infected early do not grow to a normal size.

Some growers object to the use of lime-sulphur as a late spray, inasmuch as it leaves a deposit on the fruit. Eyre and Salmon have recommended the trial of soft soap and ammonium sulphide for the late spraying, and this was substituted for the third application of lime-sulphur on half of Plot 17 (17B). Practically similar results were obtained on the two halves of this plot, but the writers are unable to draw any definite conclusions from the results owing to the fact that the third spraying may not have played any great part in reducing the disease. Plot 19, which was sprayed twice—in April and May on the same date as the two first sprayings on Plot 17—had only 1 per cent. of mildewed berries, and it should be noted that the berries from this plot showed practically no markings by the lime-sulphur when picked.

It is remarkable that Plot 22B, which was sprayed once only, on 5th May (the day before the disease was first noticed), had only 2·5 per cent. of mildewed berries. On the other hand, the result achieved on Plot 20 shows that the single spraying in this case was applied too early for the season in question. On all the plots, two or more sprayings considerably reduced the amount of disease on the shoots. Plot 12, which was sprayed also after the berries were picked, showed only a trace of wood infection, when examined on the 21st September.

Cost of Spraying.—The cost per day of spraying gooseberries is roughly as follows :—

		s.	d.
Labour ..	3 men spraying	10	0
	1 man pumping	3	4
	1 man and 1 horse carting water, etc. (half-time) ..	3	0
Apparatus ..	Wear and tear	1	0
		17	4

The average acreage sprayed per day is 2 acres, and therefore—

		s.	d.
Cost of Labour and Wear and Tear	. . per acre	8	8
Material, 6 gal. lime-sulphur* at 1s. per gal.		6	0
Total cost per application . .	per acre	14	8

* Home-made lime-sulphur costs much less than this.

Tipping.—A comparison of tipped and untipped plots (Plots 15 and 22C) shows that tipping as carried out commercially was of little value in reducing the amount of disease on this thoroughly infected plantation.

Three sprayings on an untipped plot (22A) were practically as effective as three sprayings on the tipped plots (12, 13, 16 and 17).

Conclusions.—Thorough* spraying of gooseberry bushes with lime-sulphur (1 in 40) is, in certain seasons, capable of reducing the number of berries attacked by American Gooseberry Mildew to less than 1 per cent., even with a susceptible variety like Whinham's Industry, and even when a garden has been badly affected previously.

The dates of successful application of this wash depend to a large extent upon the season. The writers regard lime-sulphur as a preventive rather than a cure, and therefore believe that the first spraying should be done before the disease breaks out in spring. The earliest appearance of the disease recorded is that of the season 1914, on 6th April, and therefore the first application should be made during the first week in April. Two further sprayings should be made at intervals of from three to four weeks.

In the season of 1916 the first week in May was a much more effective time for the application of a single spraying than the first week in April.

Thorough spraying is capable of reducing to a marked extent the amount of disease on the shoots.

Tipping as carried out commercially is of little value in reducing the disease on a badly affected area of gooseberry bushes, and can in no way compare with the efficacy of thorough spraying in a season such as the one in which these experiments were carried out.

* The writers applied 240 gal. per acre.

THE ECONOMIC IMPORTANCE OF ABERDEEN ANGUS CATTLE.

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THE value of the Aberdeen Angus breed of cattle for beef production has been repeatedly demonstrated at fat-stock shows all over the world. Their conformation is generally regarded as nearest that of the ideal beef producer, and their early maturing and crossing qualities entitle the breed to a place in the front rank of economic importance.

Well-bred Aberdeen Angus bullocks, which have been reasonably well reared as calves, maintained in good condition after weaning, and suitably kept afterwards, will weigh 7 cwt. at 1 year old, 13 cwt. at 2 years, and 17 cwt. at 3 years, but it is at 20 months old, when they should weigh 10–11 cwt., that these bullocks can be disposed of most profitably. Such bullocks invariably top the markets in Scotland and (as "polled Scots") at Smithfield.

There is a considerable number of Aberdeen Angus herds in England, but the breed has not been taken up by tenant farmers to such an extent as might have been expected. Supporters of the breed maintain that Aberdeen Angus cattle and their crosses would do well in the majority of beef-producing districts south of the Border, and surprise has been expressed that Aberdeen Angus bulls are not more largely used for crossing purposes. The reason may be due to a fairly widespread belief that Aberdeen Angus cattle are suited only to the best classes of land, or, alternatively, require heavy hand-feeding, that they require to be housed in winter, and that they are poor milkers.

Thriftiness of the Breed.— This belief may have partly originated in the fact that some of the herds in England are kept by breeders who can obtain sufficiently high prices for their stock for breeding purposes to allow of their treating their cattle better than would be the case if the calves were to be reared simply for fattening; but such treatment is not necessary. In the north-east of Scotland the breed is very largely confined to the hilly and poorer districts where it would be impossible to keep the "Scotch" shorthorn. The Highlands of Aberdeenshire, Banffshire, and Morayshire may be regarded as the "home" of the breed, and the strong constitutions and thriftiness of these cattle are doubtless due to the survival of the fittest in those "bare" years before turnips were introduced, when cattle had to eke out

an existence in winter on a limited quantity of oat-straw and such poor grass as they could find.

In several herds in England, the cows lie outside in winter, getting no extra feeding till within a fortnight of calving. The principal calving months are December, January, and February. After being weaned, in the autumn, the steer and heifer calves are usually housed in open yards, and receive hay, roots, and about 2 lb. cake, or its equivalent, per day. Yearling and two-year-old heifers can be wintered at grass, and maintained in satisfactory condition by giving a small quantity of hay or even oat-straw. In some cases no feeding other than the grass is given to two-year-old heifers in winter. It may be desirable to provide young stock with a shelter-shed in the fields, but it is not essential. Bullocks are easily fattened at from 18 to 20 months old, and give a remarkably good return for the food consumed.

Value for Milk Production.—When the main attention of breeders has been paid to the development of beef-producing qualities, it is unavoidable that milking properties should have been, to a considerable extent, regarded as of secondary importance, but experience tends to show that when compared with other purely beef breeds, such as the "Scotch" shorthorn, the Sussex and the Hereford, the Aberdeen Angus is certainly equal, if not superior, as a milk producer.

Present-day Aberdeen Angus cattle have a pedigree which goes back to heavy-milking stock. Recent research has shown that the breed is of a highly composite origin, descending from the old black Celtic cows, the hornless Norse Duns, the Aberdeenshire and the Falkland horned cattle, and deriving blood from the "Lancashire Longhorns" and the "Teeswater Shorthorns." Professor Wilson states that the hornless Dun cattle gave a large quantity of milk of quality similar to that of the Jersey. Barclay* has shown the strong influence which the Falkland breed had on the cattle of Aberdeenshire and Banffshire in the eighteenth century. It was supposed that the foundation stock, which gave rise to the Falkland breed, came from England to Scotland as part of the wedding dowry of Margaret Tudor on her marriage with James IV. of Scotland (1503), but this tradition has never been established as correct. According to Low,† in general appearance, characteristics, and milking qualities, the Falkland breed closely resembled the dairy cattle of the Low Countries. There was no native breed of cattle in

* Barclay, Transactions, Highland and Agric. Soc., 1906
† Low, "British Domestic Animals."

England in the sixteenth century to which the Falkland breed could have belonged, and whether they came through England to the Royal Palace at Falkland, or direct from the Low Countries to the Fifeshire shore, there can be little doubt that they were of Dutch origin, and, in all probability, belonged to the same race as the ancestors of the Ayrshire, the race whose purest descendants in this country are the cows of the black and white, heavy-milking dairy breed—the British Holstein Frisian.

Thus we see that from at least two important sources—the Duns and the Dutch—early Aberdeen Angus cows derived milking qualities of a high order, and it is not surprising that in the first great herd of the breed, that of Hugh Watson, the cows used to rear five calves in a season. If the cow calved in January or February her own and another calf would suckle her till about the end of April. These two were then weaned, and two more were put to her till August, when they were weaned; and a fifth calf was allowed to suckle her till she was dried off. In Scotland at the present time, in the non-pedigree herds, the cows invariably rear two, and very frequently three calves in the season, while in the smaller pedigree herds it is the regular practice for the cows with heifer calves to rear two calves, and it is not uncommon for them to rear three. On the Wye College farm it has been shown that an Aberdeen Angus cow will successfully rear three calves in a season.

In every pedigree herd in Scotland there are cows which the owners know to be heavy milkers, and cows of this breed supply the needs of the dairy on the majority of farms in the north-eastern counties. Throughout this area, farm labourers are kept on a modified "bothy" or "kitchen" system, and milk plays a very important part in the dietary arrangements. Unfortunately, it is not yet usual to keep milk records, but figures are obtainable showing one year's milk yield of 12 cows in the herd of Mr. Walker, Portlethen, Aberdeen. These figures show that, for the 12 cows, four of which were 3 years old, the average yield was 7,866 lb., the highest individual yield being 11,340 lb., and the lowest 5,750 lb.—the latter that of a 3-year old heifer. The high quality of the milk of Aberdeen Angus cows is generally admitted, and this was fully demonstrated in a series of tests carried out by the North of Scotland College of Agriculture.

Value for Crossing and Fattening.— The excellence of the Aberdeen Angus Shorthorn cross as a quick grower, a thrifty and profitable feeder, and generally as a butcher's beast is well known. Aberdeen Angus bulls are used largely in Scotland

for crossing with Ayrshire cows, and the black, polled calves of this cross find a good market. So far as is known to the writer, wherever Aberdeen Angus bulls have been used in dairy shorthorn herds in England, the cross calves have given the utmost satisfaction for feeding purposes.

It is not generally known that bulls of the breed have been used successfully on Lincoln Red Shorthorn cows in Lincolnshire. The writer has been informed, by a farmer who has followed this practice for a number of years, that the Aberdeen Angus imparts to the cross-bred better quality, earlier maturity, and greater thriftiness, than is the case with the pure-bred Lincoln, and that his experience has been that the cross is more profitable, and in greater demand with butchers.

It has been suggested, as a means of increasing our supplies of cattle at the present time, that farmers should breed from well-grown heifers at an earlier age than is usually the practice. In view of this, it may be of interest to record that in one of the largest dairy shorthorn herds in Lancashire, an attempt was made, some time ago, to breed from heifers at just over 2 years old, but considerable trouble was experienced at calving. The difficulty was overcome, however, by putting into operation a principle well known in sheep-breeding— namely, to use a neat-headed male on young female stock. An Aberdeen Angus bull was selected as likely to suit the purpose best, and the experiment proved highly successful. A bull of this breed is now regularly used on the heifers.

It would seem that, at the present time, when it is so important to economise food and labour in the production of early maturing, thrifty beef cattle, the Aberdeen Angus might be more fully utilised. All available information goes to show that farmers are likely to find the breed eminently suitable for crossing purposes. Aberdeen Angus cattle are essentially hardy and economical, and wherever they have been kept on purely commercial lines in England they have shown that they can "rough" it, and do not require "coddling."

It is to be regretted that breeders have not taken more active steps to develop the milking qualities. Within recent years the "milking" shorthorn has made rapid progress and now fills an important position. There is a keen demand, and high prices are paid, for cows combining beef and milk-producing qualities, and surely there is room for a dual-purpose Aberdeen Angus.

The writer has seen in an Aberdeen Angus herd in Kent a cow with a remarkably well-shaped udder, which regularly gives over 4 gal. of milk per day for a considerable period after calving,

and which has produced a first-prize winner at the Smithfield Show. That represents dual-purpose possibilities of a high class, and if breeders were to set out to develop the latent milking qualities they should not experience much difficulty in attaining success. Although they may be obscured, the characters associated with heavy milk production must be present in Aberdeen Angus cattle—inherited from their heavy-milking ancestors, the hornless Duns and the Falkland breed.

Further particulars regarding Aberdeen Angus cattle are given in the Board's handbook, "British Breeds of Live Stock," 1*s.* net, post free.

THE FARMER AND SELF-IMPROVEMENT.

THE question of agricultural education has received an ever-increasing amount of attention during the past few years, and grants from the Development Fund have given a new impulse to the movement for reorganisation and have enabled the central authority—the Board of Agriculture and Fisheries—to deal with it on a sound basis.

It must not be thought, however, that the central authority and the various agricultural schools and colleges which form part of the educational scheme can alone succeed in perfecting agricultural education. Farmers themselves have responsibilities which, in their own and the National interest, it is most desirable that they should keep constantly in view; by their own action they can, in collaboration with the central educational authority, do very much for themselves, very much for the agricultural interest generally, and very much to increase the agricultural output.

Mr. T. H. Middleton drew attention to the farmers' responsibilities in a paper which he read at a meeting of the Farmers' Club on 30th October last. At the outset Mr. Middleton said that it is now generally accepted that we must expect many changes in our agriculture after the War; it is further believed that among the new problems which will confront our statesmen those bearing on the proper utilisation of our land will prove to be among the most difficult. These new questions will present problems not only for the statesman: the farmer himself must share the burden of reconstruction.

The farmer and his men have taken their own share in active service for their country on her foreign battlefields. At home, under difficult conditions, the farmer has usually done his

utmost to maintain the country's food supply. Grumbling there has been frequently—that was inevitable; default there has been sometimes, but in the main there has been little shirking, and until the conflict is over we know that the farmer will stick resolutely to the task imposed upon him. But when peace ends war, when the exhilaration of the country's tremendous effort is followed by the weariness which the heavy task of reconstruction will impose, what part will the farmer play?

The efforts which have been made by our fellow countrymen and by our kinsmen from beyond the seas, so that the soil of Britain may remain inviolate, place on farmers a new responsibility. It is upon us that the fruitfulness of this well-defended land depends. When, after the war, we remain in secure and quiet possession of our farms, the debt to our fellow-countrymen will remain; and we must then realise, if we have not already realised, that the cultivated soil encircled by our safely-guarded British coast line is, in proportion to the needs of our population, an exceedingly limited area. Is each of us making the best use of his share? An attempt to give a straight answer to himself on this question is a preliminary, and in Mr. Middleton's view an essential preliminary, to the accomplishment of the farmer's task.

Mr. Middleton then contrasted some of the marked features of British and German agriculture: the respective percentages of arable land to the total land farmed, the yields per acre of various crops, and the number of persons supported per 100 acres of such crops. As these questions have been fully dealt with by Mr. Middleton in two other papers* they are not further touched upon here.

Reviewing the matter of labour supply Mr. Middleton said that farmers should give close attention not only to their immediate needs, but to questions that bear on the future supply of farm labour. The size of holdings is closely related to the supply of labour. What is required is a system of rural economy which will provide regular employment and a sufficient wage without burdening the cultivation of arable crops with the cost of maintaining half-employed labour during the winter months. To be successful, arable farming wants not only a sufficient staff of permanent labourers, but the opportunity of

* *Systems of Farming and the Production of Food: The Need for more Tillage.* T. H. Middleton, C.B., M.A., M.Sc. This *Journal*, September, 1915, pp. 520–533.

The Recent Development of German Agriculture. T. H. Middleton, C.B., Assistant Secretary, Board of Agriculture and Fisheries. (Cd. 8305, Price 4*d.*) Reviewed in this *Journal*, August, 1916, pp. 426–430.

securing occasional labour at busy seasons. The War has taught farmers that there are sources of labour in the country which, given reasonable guidance, may be much more useful than was suspected, and it may be hoped that after the War farmers will in every way encourage those of our women who are prepared to undertake occasional labour in the fields.

If the labour supply is to be increased substantially there must be progress in two directions; we must secure more rural industries which, like forests or sugar-beet factories, provide winter work, and we must extend the number of our small holdings—not necessarily statutory small holdings, but farms which can be economically worked—that is, which, if fully tilled, would afford work for one or two pairs of horses.

Coming to his main theme—the farmer himself—Mr. Middleton remarked that the improvement of himself is the chief task which the War has imposed upon the farmer.

There can be no question that the progress of invention and discovery during the nineteenth century has placed within the reach of the twentieth-century farmer great advantages denied to his forebears. The increase and cheapening in production of artificial manures; the improvements in plants and animals; the self-binder, the oil-motor, and many mechanical devices adapted for the farm, have all created for us opportunities that were not imagined by our great-grandfathers. But unless the farmer is trained so as to be able to make use of these opportunities, the full advantages which agriculture ought to gain from the advances of knowledge and discovery cannot be secured.

Those who know the close attention that is called for, if land is to be made to yield its maximum, will agree that the skill of the individual farmer is much the most important single factor in crop-production. In a good season the indifferent farmer may grow crops passably well, but trying times like the present, and difficult seasons like that of 1916, bring out clearly enough the results of enlightened management.

In his memorandum on German agriculture he had indicated the great part which a good technical training has played in the improvement of German farming. If we are honest we must admit that in the past twenty years education has not played an equal part in the development of our British soil. It is true that some twenty years ago the British public began to interest themselves in agricultural education, and teachers of agriculture began their work, but this does not mean that education then began to influence our farming methods.

Progress has, indeed, been very slow; but though slow we recognise that in the last ten years substantial advances have been made. We have now got, at least, a satisfactory framework on which to develop a system of agricultural instruction. We have research institutes at which the study of farming problems can be carried out. The fine work which Lawes and Gilbert did for British agriculture in the nineteenth century is being followed up by a band of very competent men in the twentieth century. We have good colleges and university departments of agriculture, and no student need have any difficulty in obtaining for himself a satisfactory course of instruction. Many of our local education authorities have provided competent and painstaking itinerant instructors. Attention is being given to the subject by some of our leading agriculturists. It is gratifying to find, for example, that the Central Chamber of Agriculture has recently devoted much time to the consideration of educational questions.

It must be admitted, however, that agriculturists as a class are themselves neither supporters of, nor, indeed, believers in, the value of technical education, though exceptions may be found in most districts, and in some parts of this country agriculturists are fully alive to the value of education to themselves and their children.

All sorts of reasons have been advanced to account for this state of affairs: the instruction is poor; there is no time for learning; practice is better than theory, etc. Perhaps the chief cause for the farmer's neglect of education, however, is that he misunderstands its object. He assumes that the only purpose is to give the pupil a certain amount of technical information, and he argues, often with a good deal of reason, that, in the case of a subject like farming, the small amount of information which a lad acquires at school or college can be of little use when he comes to deal with practical affairs.

The main purpose of education is not, however, to give information, but to train man's faculties for their subsequent work; and if at a certain age in life this training is neglected, the error cannot be rectified. This statement is not new; but it is a fact that relatively a very small proportion of the farmers of this country realise the importance of, what is wrongly termed, a theoretical training for their sons who are to follow them on the land.

Education is not a theoretical but an intensely practical subject, the purpose being to develop and train the limited faculties with which most of us are endowed, so that throughout

life we may use them more effectively in gaining knowledge and experience. Unless a man's intelligence is trained in the right way, and at the right time, he must be handicapped in his later years.

The value of training in many things is so obvious as never to be questioned. Everywhere men are now training for the army, and from what, three years ago, we should have regarded as the most unlikely material, magnificent soldiers have been made. Preparation for certain types of work is so obviously required that the State refuses to allow untrained men to share in it.

The farmer himself fully appreciates the value of training for his animals, and does not hesitate to give time and money for the training of the horse that is to work on his land; but, if not verbally, at least in action, he questions the value of training for his son who is to manage it. But the brain of the lad can be trained with as much certainty as the intelligence of the horse, and usually with greater effect! It may be said that the farmer does not question the value of training for his son, but believes that horse and son can equally be well trained by working on the land. It will be affirmed that it is a "practical" training which is of real value to a lad who is to succeed his father on the farm. Mr. Middleton agreed, but would ask, "What is a practical training?" He was not likely to undervalue the need of experience to the farmer, as it is impossible to make any success of farming without some experience, but experience can only be got in one way—each man must get it for himself. Farming depends so largely on local conditions that the man who carries on traditional methods derived from his ancestors is quite likely to make a respectable show as an agriculturist when all goes well with farming; but a man who merely lives upon the experience acquired by his forefathers has no title to claim that he is himself a "practical" farmer. To earn this title a man must have gained experience for himself; the real practical man is the farmer who has trained himself, so that he is capable of meeting changes in demand, and is always ready to adapt his methods to new conditions. It is an easy matter to pass for a "practical" farmer in good times. It is the trying season and changing times such as those in which we are now living that separate out the really practical man from his fellows.

If it be admitted that we must measure a man's practical skill in farming by the experience which he has gained for himself, not by the excellence of the traditions which he has

inherited from his fathers, then any process of training likely to enable a man to gain experience quickly must be of value to the farmer. This is what education does: it develops a man's powers of observation so that he may see quickly and accurately, and trains his brain so that he may reason clearly and correctly. We have two eyes, and there can be no question that training at a certain period of life will make them better. We have one brain—the "inherent capability" of which varies but slightly from generation to generation, but which may be wonderfully improved when its "condition" is properly looked after. Of this fact agriculturists see many examples among kinsmen who leave the land to become lawyers or doctors or engineers.

We are slow to admit, however, that for those who remain on the land education has a similar value; we act, at least, as if we did not think there was much advantage in bringing our brain into "high condition" in early life. "Condition" in the land we must have, of course; "condition" for the brain need not trouble us—we may depend on "inherent capability." This, Mr. Middleton feared, was the usual conclusion of agriculturists when debating the value of education to themselves, and thus the furrows of the farmer's brain are too often the least fertile furrows on the farm!

If the farmer of the future is to take full advantage of the resources which the advance of knowledge and the achievements of industry are now placing at his disposal, he must prepare himself for his task by giving more thought to his early training.

The great achievements of our forefathers in the eighteenth and early nineteenth centuries were due to intellectual movements; movements which trained the minds of the men that tilled the land. It was on the "energy" accumulated in these far-off days that our agriculture ran smoothly through the middle of the nineteenth century. It was because the source of energy dried up that we have felt so keenly the blow that fell in 1879.

Few farmers realise the immense amount of study that was given to agriculture in the British Isles during the eighteenth century, and fewer still realise how marvellously successful were the efforts of our early improvers. Considering the resources of the time, the increase in food production in the latter half of the eighteenth and the early nineteenth century was greater than anything we can point to in Germany. Porter tells us that the land of Great Britain, which in 1760 fed a population of eight millions, by 1831 supported 16 millions;

and this was before our modern breeds of live stock had been developed, before artificial manures were available, before thorough drainage was known, before oil-cakes had come into common use, before the steam-engine had worked for agriculture.

The problem of food production was much discussed 150 years ago. Here, for example, is a significant note from a letter of 1776: "Our gentlemen who live in the country have become active and industrious; they embellish their fields, improve their lands, and give bread to thousands," and here is a parallel note from a North German writer of 1794, who laments the backward state of their agriculture and explains it by saying: "Our noblemen are no farmers and our farmers no gentlemen; our authors in agriculture possess no cultivated land, and those few who could give to the public the precious results of long experience and labour would starve their printer for want of readers."

The effect of this eighteenth-century comparison is heightened if we recall Von Bülow's slighting allusion to British farming in his work "Imperial Germany": "We should go the way England has gone."

War has drawn our attention to the strength derived by an enemy from a developed agriculture. Germany to-day is realising, as Britain realised in the past, the benefits that come to the nation which fosters this industry. In Germany to-day, and not in Germany alone, but in those other countries which have recently made progress in agriculture, chief attention has been given to the problem of *improving the cultivator as a preliminary to improving the land.* The general conditions in these countries have varied; and, looking back in our own agricultural history, we find in it conditions which differed widely from those of Northern Europe and the United States of America in the beginning of the twentieth century; but throughout a long period and within these many countries one condition has not varied. Preceding each forward move in agriculture, governments, or societies, or educational institutions "have applied themselves to the study of this most useful art," and have discovered that *the first essential for the improvement of agriculture is the improvement of the farmer himself.*

The farmers art in this country has in many respects reached a high level; but we cannot stand still. Agriculture must be a progressive industry; each new generation of farmers must be trained for the work that lies ahead of them. In urging the need for the training of the men who are entrusted with the cultivation of our land the Farmers' Club and other farmers'

societies throughout the country could do much to help British agriculture in the years that lie ahead ; for agricultural education in this country has now reached a stage in which it requires all the help it can get from farmers' societies. In a general way we are agreed as to the advantages of education ; but when it comes to close quarters the farmer, for reasons obvious enough, is not very willing to accept it.

The improvement of himself is for the farmer, as for other men, the hardest part of his task.

THE ENCOURAGEMENT OF CHEESE PRODUCTION.

AMONG the measures which can be taken to increase the supply of home produced food, the manufacture of larger quantities of cheese takes an important place. This course has been repeatedly advocated by the Board, and the arguments in its favour may be briefly restated.

In the first place, there is, in milk-selling districts, in the flush season, considerable wastage of surplus milk—no milk factories for cheese-making from surplus milk exist. Secondly, experiments carried out at Woburn and elsewhere have demonstrated the utility of various substitutes for whole milk and separated milk in calf rearing ; it is certain that, in general, new and separated milks are used much longer than is necessary in calf rearing. In the third place, the fact must be faced that good margarine is as wholesome and nutritious as butter, and is less expensive ; and the materials used in the margarine industry are taken largely from palm kernels, coconuts and ground nuts grown in British Colonies. It is hoped that the trade in these products and the manufacture from them of margarine and animal feeding-cakes will be retained in British hands after the War. Except in so far as separated milk is necessary for calf rearing (and as stated above, its use in this direction could be curtailed) there is no reason from the food standpoint why butter should continue to be made. Further, at present, the manufacture of cheese is much more profitable, yielding an extra profit over that from butter-making certainly of 3*d.*, and possibly of about 6*d.*, per gallon of milk used (see this *Journal*, September, 1916, p. 598, and October, 1916, p. 668).

The storage of milk as cheese is, in a sense, a conservation of energy, and it is generally admitted that, for people undergoing hard physical labour, cheese is almost unrivalled as a food. It should be possible to spare for cheese-making at least 10 per

cent. of the milk now used for other purposes, and this would probably result in an additional 64,000,000 lb. of cheese being produced in the 7-months' season.

On the outbreak of war attention was called (see this *Journal*, September, 1914, p. 561) to the use of surplus milk for cheese-making, and (p. 567) to the Board's leaflets on cheese-making and calf-rearing. In October, 1915, a special leaflet on the importance of producing more cheese was published, and in the following month the leaflet on calf rearing was re-written.

The issue by the Board of printed advice to produce more cheese was followed by the encouragement of instruction in cheese-making. A circumstance which militated against increased production was that most farmers are more familiar with the art of butter-making than that of cheese-making, the latter being more complicated and requiring greater skill; and there was, in general, a lack of knowledge as to the variety of cheese best suited to local conditions.

The necessity for the employment by local education authorities of additional instructors in cheese-making was evident. Various local education authorities were, therefore, invited by the Board in the summer of 1915 to establish a number of migratory cheese schools, or to increase the number of existing schools; it was proposed to attach two instructresses in cheese-making to each school, the latter working at a suitable farm for from two to four weeks (according to the difficulty of the process for making the particular kind of cheese suited to the locality); one instructress was to remain for from two to four weeks to set her pupils to work in their own homes, while the second instructress moved with the school to a fresh centre, the first instructress resuming charge at the third centre while the second instructress remained at the second centre, and so on. Grants were promised by the Board towards the expenditure of the local education authorities, and the expenditure was not to exceed £20 per month. It was recognised that the provision of apparatus would prove an expensive item to the local authorities, and the Board were successful in obtaining a grant of £500 for the purchase of sets of apparatus and loan of such to the local education authorities.

The above scheme of the Board was discussed with the education authorities of 32 counties in England and one in Wales by one of the Board's superintending inspectors for agricultural education, and, as a result, 22 authorities accepted the scheme and expressed themselves willing to take action 3 came to no definite decision and 8 decided to take no action

Of the 22 counties favourably disposed towards the scheme 18 have definitely taken action, and between them 26* new travelling cheese schools have been established, while 5 similar schools which previously existed have been maintained; so that there were, on 30th June, 1916, 31* schools where 5 previously existed. In addition to this, the staff teachers of butter-making in 8 Welsh counties are now giving instruction in cheese-making. This increase has involved the temporary appointment of 21 additional instructresses; 23 regular staff teachers of dairying who in previous years were engaged for the most part in teaching butter-making, are now devoting their attention almost exclusively to conducting classes in cheese-making. Thus, at the end of June, 1916, there were some 44 teachers engaged in carrying on migratory cheese-making instruction in England and Wales. The numbers of schools and teachers in counties where cheese-making is being encouraged were as follows:—

COUNTY.	Teachers Employed.		Schools Working.	
	Regular Staff.	New Temporary Appointments.	Previously existing.	Established in 1916.
Cornwall	1	5	0	4
Devon	2*	3	0	3
Somerset	3	0	2	1
Wilts	1	3	0	3
Gloucester	1	0	0	1
Hereford	1	2	0	2
Salop	2†	0	1	1
Staffs	1	1	1	1
Cheshire	1	1	0	1‡
Derby	0	1§	0	1
Cumberland & Westmorland	1	1	0	2
Durham	1	1	1	1
Lincs (Lindsey)	0	1	0	1
E. Suffolk	1	0	0	1
Rutland	0	1§	0	1
Hants	1	0	0	1
Carnarvon	0	1	0	1
Other Welsh Counties ..	[6]	[0]	[0]	[6]
Total	23	21	5	32
	44		37	

* Partially. † Includes 1 teacher specially appointed for cheese-making in 1916.
‡ Occasionally 2 schools are held at the same time. § The same teacher.

In the 1916 cheese-making season instruction had been given at approximately 200 centres by 30th June.

In making loans of apparatus it has been necessary, owing to

* Exclusive of 6 in Wales.

the limited sum of money available, to discriminate between counties; for the most part preference has been given to those counties where cheese-making is either a new or defunct industry.

While it may fairly be claimed that the scheme has already had the effect of increasing the output of cheese in this country,* and that, in consequence of the work of the schools cheese-making is replacing butter-making, and much surplus milk formerly misused is now being conserved as cheese, it is evident that much further improvement remains to be effected.

One of the most pleasing results of the work of the schools (and the same thing is happening in most of the counties where instruction has been undertaken) is that it is leading dairy farmers to realise the advantages to be gained by co-operation in the manufacture of cheese, and by giving them a knowledge of the processes of cheese-making it is fitting them to become suitable co-operators.

In this connection reference may be made to the work of a co-operative cheese school established in Cornwall at the end of May. Instead of establishing five cheese schools, as was at first intended, the local authority set up three schools in April, 1916, and a co-operative school replaced the two further migratory schools, a demand for a co-operative school having resulted from the work of the three travelling schools. The co-operative cheese school is a school in which the volume of milk dealt with is larger, and the migratory speed of which is somewhat slower, than is the case with the ordinary travelling cheese school. Instruction in cheese-making on a broader scale is possible. Those resident within easy reach of the school are received as daily students, and a selected number of others from a distance are given scholarships to become resident at or near the school for a time. Instruction in co-operation is afforded in that the school is only located at a centre where the farmers of the district will jointly undertake to supply daily a given quantity of milk (usually not less than 200 gallons); to accept payment for their milk on a strictly co-operative basis; and to appoint, pay, and place under the direction of the county instructress in charge of the school, for so long as the school remains at that centre, some person approved by the instructress, whom they propose shall act as their manager in the event of their deciding to make cheese co-operatively after the close of the school at that centre. Normally, a co-operative cheese school remains at a centre for from 8 to 12 weeks, by which time it is considered that the

* Reports relating to very many of the counties showed that the pupils instructed were on 30th June making cheese on their own holdings.

people of the district (1) will have been fully instructed in cheese-making; (2) will have been provided with a demonstration of the benefits of co-operation; and (3) will have been given time to purchase a set of appliances for themselves should they desire to do so.

A further instance of the incentive given to co-operation is that after a visit of one of the migratory schools to a village in Cornwall a few farmers in that district co-operated and established a small cheese factory which is now at work. Requests for further co-operative cheese schools have also been received by the local education authority.

Brief notes on the position in certain counties on 30th June, 1916, are given below.

Devon.—The Authority decided to conduct two schools. After less than two months' experience of the work of these two schools they started a third, which in itself explains the success of the undertaking.

There is scope in Devon for still more work. Large quantities of butter are still made, and in other ways a great bulk of milk is not economically used.

Somerset.—This large cheese-making county has for many years paid systematic attention to instruction in cheese-making, but this year it has added to its provision of instruction, by placing its former butter-making instructress in charge of a cheese school, specially arranged to meet the needs of small holders.

Wiltshire.—The two schools which opened at the beginning of the season have been successful, and a third school is being established. Much butter is still being made in this county, particularly by the small holders.

Gloucestershire.—The scope for work in this county has been considerably restricted because two companies have each established a milk collection depot in the heart of the chief milk-producing area. The Authority have, however, set up, for the first time, a travelling cheese school, which has already attained a measure of success exceeding their expectations.

Herefordshire.—Cheese-making is practically a new industry in this county. The Committee were induced to try a few experimental courses last autumn (1915), and the result was that considerable interest in favour of the movement was aroused; so much so that the Education Authority decided to carry on a systematic campaign from the commencement of this season. They, therefore, established a travelling cheese school. From this beginning the work has grown so rapidly that they have recently been obliged to set up a second school. It is now reported that quite a considerable quantity of cheese is being made from surplus milk which was previously put to less economic use.

Salop.—The northern portion of this county is largely devoted to cheese-making, and for the last two years (1914–15) the Education Authority have provided peripatetic instruction with the object of assisting the regular makers. This year they have set up a second school to teach, more especially, small holders, and to demonstrate to them that cheese-making pays better than butter-making. Highly successful results are being obtained by both these schools.

THE following note has been communicated to the Board by Mr. A. T. Johnson :—

The Littering of Poultry-Houses.

The great increase in poultry-keeping, and the widespread adoption of some form of scratching-shed for winter layers, necessitate the use of an efficient and cheap material as litter. This material is not only of great importance as a mere floor-covering, to keep the birds warm and dry in cold and damp weather, but it is, as a scratching medium, essential to the promotion of healthy activity. Further, the litter should be an absorbent and a deodoriser, since it can only be a means of maintaining hygienic conditions and economising labour if it will remain sweet in the poultry houses throughout the winter. Finally, in selecting a litter, its ultimate use when, in combination with the poultry-manure, it is to be used as a fertiliser, must not be forgotten. Materials like sawdust and shavings may serve merely as a litter, but as their manurial properties are practically nil the value of the resulting manure is much reduced.

Peat Moss.—This substance is without a doubt the finest of all litters for a scratching-shed. It is the best absorbent and deodoriser for this purpose with which the writer is acquainted. It is warm and dry without being dusty. It most effectually "holds" the ammonia of the fowl manure until it is transferred to the land, when it becomes a useful addition to any soil deficient in humus. Although it can be secured at a much lower figure in some parts of the country, baled peat-moss is worth £4 a ton carriage paid (an outside price even in war time) to any poultry-keeper who looks upon his litter as a means of increasing winter egg-production and who places a manurial value upon its after-use on the land. Peat-moss varies considerably in texture, the most fibrous being the best for the purpose under consideration. It should be laid down not less than eight inches thick and, it should be scarcely needful to add. the sheds must be water-tight, with their open parts protected against driving rain and snow.

Bracken.—This is another useful litter which can often be secured for the cost of gathering. It is best when cut green, dried and stacked, the reasons being (1) that green bracken contains a higher percentage of manurial constituents than that which has died naturally, and (2) it is less woody and therefore decomposes more easily when transferred to the soil. Before being used for poultry-houses, however, bracken should always be chaffed into three-inch or four-inch lengths. In this form it is not only a better scratching material—shortness being an important desideratum—but the process crushes the woody

stems, and renders the manure more useful. Since a good bed of chaffed bracken soon gets broken into fine particles by the birds it becomes a fairly good absorbent, whilst its properties as a potash fertiliser are well known.

Autumn Leaves.—The dry leaves of hard-wood trees, such as oak, beech, chestnut and hornbeam, make an economical litter for poultry-houses. Indeed, what has already been said in favour of bracken may be said of leaves, which possess the advantage that they require no preparation. Whenever they are dry they can be transferred straight to the houses, but it is desirable to have a reserve in stock from which those in use may be replenished from time to time. It is possible to use leaves alone without jeopardising the principles of economy and efficiency, but they are not so effectual as a deodoriser as peat-moss, nor have they quite enough body, especially when fresh, to afford that slight resistance which a good scratching material should possess. Half-decayed leaves from wood bottoms, if secured dry, will considerably help matters, and their addition to the litter will, of course, give more value to the material from the cultivator's point of view. Generally speaking, however, the writer has found it best to use peat-moss as a foundation for both autumn leaves and bracken. By so doing one can economise in peat-moss and render the leaves and fern more efficient as a litter and yet have a first-rate manurial product at the end. Neither soil nor dry coal-ashes are satisfactory additions to litter, as both create dust.

Grain Husk.—The chaff, or winnowings, from the threshing machine possesses many of the attributes of a good poultry-litter. It can generally be secured very cheaply, and at a season when it is most wanted. It is warm and dry, and usually contains a few grains of corn which will keep the birds employed for a long time. Here also, however, a certain amount of body, or weight, is wanting, and this cannot be better supplied than by a substratum of peat moss. Although mixed winnowings may be used, those containing a preponderance of barley beards should be avoided, since they are liable to bring about the trouble described as "crop-bound."

Hay and Straw.—Even if the question of national economy did not arise, hay and straw (unless they are very short) do not make such good litter as any of the foregoing. In a poultry-run they have not the same powers of absorption as most of the other substances mentioned, and if used along with peat-moss they are liable to interfere with the free handling of the spent litter. Furthermore, the hollow stems afford a retreat for insect and fungus pests.

The Wintering of Store Cattle.

THE question as to the respective merits of liberal or restricted winter feeding of store cattle, which are subsequently fattened on pastures, is of some importance, more especially at the present time when the prices of feeding-stuffs are so high. Practice varies somewhat according to district and the individual views of farmers, some preferring to feed liberally for high winter gains, while others are contented if their stores retain sufficient condition to enable them to put on weight rapidly during the grazing season.

A number of recent experiments carried out quite independently and in different countries point to the conclusion that, where animals are to be carried over the winter as stores, grazed in spring, and sold fat at the end of summer, liberal feeding during the winter is unnecessary. The liberally-fed animals may make greater winter gains (which may or may not be financially economical when the winter period only is considered) than animals not so fed, but the difference between the respective groups of animals diminishes when they are turned on to the pastures, and will probably disappear almost entirely by the time of sale. It follows that if stores are liberally fed during the winter care should be taken that they are not purchased in spring at too high a price.

The following results of experiments serve to illustrate the point under consideration :—

Ireland.—At the Irish Department of Agriculture's station at Athenry, in the west of Ireland, experiments were carried out during four winters, and the yearly results were remarkably uniform, in spite of differences in the character of the winters. The animals tested numbered 108 : 48 Aberdeen Angus cross-bred bullocks, 30 Aberdeen Angus cross-bred heifers, and 30 Shorthorn cross-bred bullocks. To eliminate any error from differences of breed and sex only animals of the same breed and sex were included in any one winter. The animals averaged 21 months of age, and the experiment lasted in each year from the end of November until the end of July.

The animals were divided into three lots. Those in Lot I. were kept housed, day and night, through the winter ; they were fed with roots, cake and meal, and straw. Lots II. and III. were not housed, but were given hay on the grass from about January to the end of March, Lot II. being allowed cake in addition.

The cattle were then grazed together under similar conditions for twelve weeks to ascertain the effect of the winter feeding on subsequent growth. The following table shows, for the average of the four years, the increase per head during the winter and summer periods, respectively, and the cost of feeding, per head, during the winter period (roots were charged at 8*s*. per ton, straw at 30*s*. per ton, hay at 40*s*. per ton, cake and meal at 8*s*. per cwt., and pasturage at 20*s*. per head). No figures

were given for the cost of feeding during the summer period as this was regarded as the same for all three lots :—

—	Cost, per Head, of Winter Feeding.	Winter Increase, per Head.	Summer Increase, per Head.	Total Increase, per Head.
	£ s. d.	c. q. lb.	c. q. lb.	c. q. lb.
Lot I.	4 7 3	1 1 9	0 3 9	2 0 18
" II.	3 1 6	0 2 22	1 2 13	2 1 7
" III.	2 5 6	0 1 18	1 2 27	2 0 17

Considering even the winter feeding only, the increase of Lot I. over Lot II. of 71 lb. per head was made at a cost of £1 5*s.* 9*d.*, or 40*s.* 7*d.* per cwt. ; the increase of Lot I. over Lot III. of 103 lb. per head was made at a cost of £2 1*s.* 9*d.*, or 45*s.* 5*d.* per cwt. ; so that, if weight only is considered, the increases of Lot I. over Lots II. and III. would hardly, if at all, pay for the extra food consumed. Further, it was found that the less liberally winter-fed cattle invariably increased much more rapidly during the ensuing summer than those more liberally winter-fed, and when the whole period (winter and summer together) is considered it will be seen that the more liberally winter-fed animals did not make any greater gains in live-weight than those less liberally winter-fed; so that over the whole period the extra cost of winter feeding was a direct loss.

The same conclusion holds good when considering the advisability of feeding cake to the out-wintered cattle ; it will be seen that an extra increase in weight of 32 lb. was produced by cake costing 16*s.* ; the cake-fed lot were in better condition, and would probably have realised 1*s.* more per cwt. if sold about the end of April. The difference in condition between the two lots, however, was lost at the end of the summer, while the difference in weight was only 18 lb. per head.

In the above experiment, and in all others carried out by the Irish Department of Agriculture, where cattle were housed day and night during winter, the animals lost weight during the first two or three weeks after being put on the grass. It was thought that if cattle were housed at night only and turned out for a run during the day they would not, in all probability, undergo any material reduction in weight when changed to their summer quarters.

Northumberland.—In an experiment carried out at the Cockle Park Station in 1911–12 it was the out-wintered animals that received the more liberal feeding, since the foods fed contained the same amounts of nutrients as in the case of in-wintered animals, while those wintered outside ate considerably more pasture during the winter.

Twenty-one blue-grey calves of about 8 months old, averaging 452 lb. in weight, were divided into three lots ; all received 6 lb. meadow-hay and 1¾ lb. soya cake, and, in addition, Lot I. (6 animals) got 25 lb. swedes, Lot II. (6 animals) 33½ lb. yellow turnips, and Lot III. (9 animals) 2 lb. maize meal plus 2¼ lb. oat straw, per head per day, these foods containing the same amounts of nutrients. The first two lots were wintered in boxes and turned out to pasture in the day when weather permitted, while Lot III. was wintered outside, with the use of a shelter shed open to the south. The winter period lasted from

29th December to 19th April, after which followed an intermediate period till 23rd May (during which all the animals were pastured but received soya cake and maize meal), which was followed in turn by the summer period till 29th August, when the animals were on pasture only.

The following table shows the gains in live-weight (average per animal) :—

—	Winter Period.			Intermediate Period.		Summer Period.		Three Periods.
	Live-Weight. Dec. 29.	Live-Weight. April 19.	Gain per Head per Week.	Live-Weight. May 23.	Gain per Head per Week.	Live-Weight. Aug. 29.	Gain per Head per Week.	Gain per Head per Week.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Lot I. ..	451	578	**8·0**	598	**4·0**	816	**15·6**	**10·5**
„ II. ..	443	576	**8·4**	590	**2·4**	799	**14·9**	**10·2**
„ III. ..	463	623	**10·0**	634	**2·2**	822	**13·4**	**10·3**

Lot III., wintered out, made the greatest increases per head in the winter period ; the difference, however, was caught up by the other two lots during the ensuing pasture periods, and at the end there was not much to choose between the three lots as regards live-weight increases over the whole experiment.

The results of a similar experiment in 1912–13, however, were not so striking as the earlier results. This time the lot that was out-wintered received a ration considerably poorer in digestible protein and carbohydrates than the in-wintered lots. The rations were, for Lots I. and II. (in-wintered) : 6 lb. meadow hay, 1¾ lb. soya cake and 25 lb. swedes (or 33½ lb. turnips), and for Lot III (out-wintered) 9 lb. meadow hay, 1 lb. Bombay cotton cake and 1 lb. soya cake, per head per day. In the winter period of 16 weeks (6th December to 28th March) the live-weight increases per head per week were : Lot I. 6·30 lb., Lot II. 6·62 lb., Lot III. 1·86 lb. Lot III. gained on the other lots during the summer period (28th May to 1st August) but not to such an extent as to equal over the whole experiment the gains made by the other two lots. The live-weight increases per head per week during the summer period were : Lot I. 15 lb., Lot II. 13·8 lb., Lot III. 15·3 lb.

United States.—Trials extending over three seasons, with the object of ascertaining the influence of winter feeding upon gains made during the following summer, have been made in Alabama by the Alabama Experiment Station in co-operation with the United States Bureau of Animal Industry.

Steers of about 700 lb. live-weight were purchased each autumn, divided into lots, and wintered in five different ways, viz. : (1) "range" (*i.e.*, turned on to grass, cotton, and maize fields) ; (2) "range," together with cottonseed meal and hulls ; (3) "range," and cowpea hay ; (4) "range," and damaged hay ; and (5) "range," and cotton seed. At the end of the winter the steers were redivided into groups to test various methods of summer fattening, and were so divided that some of the animals of each winter lot were placed in each group of cattle for the summer fattening. The summer feeding consisted of : (1) pasture alone ; (2) pasture and cotton seed cake (medium ration) ; (3) pasture and cold-pressed cake ; (4) pasture and cotton seed ; (5) pasture and cotton seed cake (heavy ration) ; and (6) pasture, cotton seed cake and lucerne hay.

The winter and summer gains from the various kinds of winter feeding are shown in the following table, in which the different methods of summer feeding are grouped and averaged :—

Method of Wintering.	No. of Steers.	Average Weight in Autumn	Average Gains (+) or Losses (—) per Head per Day.		
			Winter.	Summer.	Combined Winter and Summer.
		lb.	lb.	lb.	lb.
Range alone ..	72	688	— 1·10	+ 2·09	+ 0·74
Range + cotton seed meal and hulls ..	68	698	+ 0·09	+ 1·76	+ 1·06
Range + cowpea hay	24	724	— 0·11	+ 1·86	+ 1·01
Range + damaged hay	43	680	— 0·67	+ 1·83	+ 0·77
Range + cotton seed	25	706	— 0·40	+ 1·93	+ 1·00

The following table gives the results for summer fattening on pasture alone, without supplementary food :—

Method of Wintering.	No. of Steers.	Average Weight in Autumn	Average Gains (+) or Losses (—) per Head per Day.		
			Winter.	Summer. (Pasture fed only).	Combined Winter and Summer.
		lb.	lb.	lb.	lb.
Range alone ..	17	662	— 1·02	+ 1·79	+ 0·62
Range + cotton seed meal and hulls ..	18	723	— 0·16	+ 1·53	+ 0·83
Range + cowpea hay	9	767	— 0·25	+ 1·52	+ 0·76
Range + damaged hay	11	648	— 0·70	+ 1·59	+ 0·65
Range + cotton seed	5	657	— 0·45	+ 1·84	+ 0·95

If the various methods of summer fattening are considered as a whole, it will be seen that the animals which did best in winter on account of richest feeding did worst in summer. The animals which did worst in winter on account of poorest feeding did best in summer; this was also true so far as summer fattening on pasture alone was concerned (with the exception of the animals that were wintered on cotton seed in addition to range). In both instances, considering the combined winter and summer gains, the animals wintered on range alone did practically as well as those wintered on range and damaged hay.

As regards the financial aspect, the extra cost of winter feeding for such lots as received supplementary winter feed averaged 18*s*.* per head, and over the combined periods these animals gained on the average

* On the basis of prices in England the extra cost would have been between double and treble this amount.

60 lb. more per head than the animals wintered on range alone. The animals sold for 2¼*d.*, a lb. and the value of the increase was therefore 11*s.* 3*d.*, so that, financially, there was a loss.

The report on these experiments is emphatic in stating that if the steers in these tests had been grazed until pasture gave out in October instead of being sold in July and August, it is extremely doubtful if any difference could have been detected between the steers which wintered on range alone and those which received feeds.

"The results for the three years have been such that the statement seems justified that it will not pay to feed mature steers of medium or inferior quality during the winter if they are to be kept until the end of the following summer, provided the waste lands, old fields and the stalk fields of the farm will yield enough feed to keep them strong and thrifty until spring comes. This is true even though the steers may become very thin in flesh during the winter."

Germany.—The German experiments were carried out at the experiment station of Dikopshof, University of Bonn. The report on them seems to have been occasioned by the scarcity of hay in Germany, these experiments being concerned with the wintering of young cattle without hay.

Particulars and results of winter feeding are given in the following table :—

Experiment.	Age at Start.	Rations per Head per Day. Ground Nut Cake.	Oat Straw.	Roots.	Dried Root Leaves.	Results. Initial Weight.	Length of Test.	Increase.	Cost per Head for 180 days.	
	Months.	lb.	lb.	lb.	lb.	lb.	Days.	lb.	s.	d.
1912–13..	17	2·2	11·0	22	—	832	166	152	73	9
1913–14—										
Group A	17¼	2·2	11·0	22	—	792	134	132	73	9
" B	17	1·1	11·0	22	—	832	134	121	57	7
1914–15—										
Group A	8¾	1·1	8·5	—	5·0	642	113	73	61	2
" B	12½	1·1	8·8	—	5·0	779	113	35	61	2
" C	16	0·5	11·0	—	5·0	805	85	— 2	57	7
" D	18¾	0·0	11·0	—	5·0	926	85	2	48	7

The experiments were continued over the summer pasture period in 1914 and 1915. The winter and summer gains, separately and combined, were as follows :—

Experiment.	*Winter Increase.*		*Summer Increase.*		*Increase over Whole Period.*
	lb.		*lb.*		*lb.*
1913–14 A ..	132	....	218	....	350
B ..	121	....	202	....	323
1914–15 A ..	73	....	178	....	251
B ..	35	....	174	....	209
C ..	— 2	....	268	....	266
D ..	2	....	222	....	224

Considering the two years as a whole, the animals that made smallest gains in winter made the largest gains in the summer period; considering 1914–15 only the biggest increase over the whole year was made by the animals that did worst in winter, and Group D (poorly fed) did better than Group B (fed better).

It is concluded that dearer winter feeding is in no way accompanied by a corresponding increase in live-weight over the whole year, and that dear winter feeding with feeding-stuffs at their present price [in Germany] is a doubtful policy.

The results agree with other German experiments carried out by Schneider at Kleeberg, which showed that during the pasture period animals cheaply wintered approached those more liberally wintered.

Schneider also showed that the better wintered animals made the largest losses at the beginning of the pasture period.

In the report on the Bonn experiments it is considered that in times like the present the following rations can be recommended, in the absence of hay, to carry young cattle over the winter, provided there is good pasture to follow:—

Age at Start.	*Concentrates.* lb.	*Oat Straw.* lb.	*Roots.* lb.	*Dried Sugar Beet Leaves.* lb.
½—1 year ..	1·1	8·8	17·6	3·5
1—1½ „ ..	0·5	11·0	22·0	4·4
1½—2 „ ..	—	13·2	26·4	5·3

Notes on Feeding Stuffs in November: *From the Animal Nutrition Institute, Cambridge University.*

AGAIN this month there is a substantial rise in prices, which is most pronounced in the case of all kinds of starchy foods such as wheat offals, rice, maize, oats and barley. All such foods are now exceedingly dear. It is impossible to buy any food of this description for less than 2*s.* 3*d.* per unit, and in most cases the price is much above this figure. It is quite without precedent on British markets for starchy foods to be comparatively dearer than foods rich in protein and oil. In these circumstances it is by no means an easy matter to design well-balanced rations at anything like reasonable prices.

Prices of feeding stuffs at Glasgow and Leith have been included this month by request of Scotch readers of the *Journal.* The number of tables has consequently been increased.

The quotations at these markets have been obtained from the weekly *Return of Market Prices* issued by the Board of Agriculture for Scotland. In the Scotch weekly return the number of food units per ton is worked out on a basis which gives no credit for the digestible fibre. It has been the custom in these notes to count the digestible fibre as equal in value to digestible carbohydrates, and hence the prices per unit in the Scotch returns and in these notes do not exactly agree. Varying trade names may also cause a further discrepancy, especially in the case of foods such as wheat offals.

Rations.—The following rations are suggested for this month :—

Horses.—The high price of all kinds of starchy foods makes it difficult to suggest any improvement of the rations given last month. They may, however, be made slightly cheaper by using distillery grains in place of dried brewers' grains.

Cows.—The rations suggested last month can be made slightly cheaper by replacing dried brewers' grains and bran by distillers' grains or malt culms. In the case of malt culms replacing either grains or bran it would be necessary to use 4 lb. in place of 3 lb. bran or grains.

Where it is impossible or inconvenient to increase the allowance of roots per head above 4 stones the following

TABLE I.

Feeding Stuff.	Digestible Food Units.	London. £ s. d.	Liverpool. £ s. d.	Hull. £ s. d.	Bristol. £ s. d.	Glasgow. £ s. d.	Leith. £ s. d.
		Approximate Prices per ton at the end of October.					
Soya Bean Cake	122·3	—	—	13 10 0	13 15 0	—	—
Decorticated Cotton Cake ...	126·3	14 7 6	13 10 0	—	14 5 0	14 0 0	14 0
American Linseed Cake ...	119·0	—	—	—	—	—	—
Indian Linseed Cake	123·1	14 10 0	13 10 0	—	—	14 0 0	13 5
Russian Linseed Cake ...	123·5	—	—	—	—	—	—
English Linseed Cake... ...	120·1	15 0 0	14 15 0	14 5 0	14 15 0	15 5 0	14 5
Bombay Cotton Cake	65·3	—	10 10 0	10 12 6	10 17 6	10 15 0	10 15
Egyptian Cotton Cake ...	71·0	10 15 0	11 0 0	11 0 0	11 2 6	—	11 0
Coconut Cake	102·0	11 12 6	—	—	12 0 0	—	—
Palm Kernel Cake	96·1	10 10 0	9 15 0	10 0 0	10 10 0	10 10 0	10 10
Palm Kernel Meal (extracted)	92·5	—	—	—	—	—	—
Ground-nut Cake	145·2	14 12 6	12 5 0	—	14 10 0	13 15 0	14 15
English Beans	99·5	12 12 8	—	13 9 6	13 1 0	—	—
Bean Meal	99·5	—	—	—	—	15 5 0	15 0
Chinese Beans	101·2	12 16 8	14 0 0	—	—	—	—
English Maple Peas	97·2	13 6 8	—	17 15 7	—	—	—
English Dun Peas	97·2	12 17 9	—	16 13 4	—	—	—
Calcutta White Peas	97·5	16 8 11	—	—	—	—	—
American Maize	93·8	12 2 8	12 9 3	12 16 8	—	}	
Argentine Maize	94·2	12 7 4	12 10 2	12 16 8	12 5 0	} 12 10 0	12 10
Maize Meal	86·5	13 0 0	13 10 0	13 0 0	12 15 0	13 5 0	13 10
Maize Gluten Feed	121·0	12 12 6	—	—	12 10 0	—	—
Maize Germ Meal	99·2	12 15 0	12 10 0	13 0 0	12 15 0	—	—
English Feeding Barley ...	83·0	—	—	15 13 7	15 2 5	—	—
English Oats	75·4	12 10 0	11 16 5	12 3 4	11 0 0	}	
Argentine Oats	75·4	13 8 11	—	—	10 13 8	} 12 10 0	12 0
Malt Culms	66·9	7 17 6	9 0 0	7 15 0	8 5 0	8 10 0	8 0
Brewers' Grains (dried) ...	84·5	9 12 0	—	8 15 0	9 5 0	8 17 6	9 0
Brewers' Grains (wet) ...	21·1	1 9 0	—	1 10 0	—	—	1 7
Distillers' Grains (English) ...	101·2	10 7 6	10 10 0	—	10 5 0	}	
Distillers' Grains (French) ...	101·2	10 7 6	—	—	—	} 9 0 0	9 10
Egyptian Rice Meal	78·7	12 0 0	—	—	—	}	
Burmese Rice Meal	78·7	—	11 12 6	—	12 0 0	} 11 10 0	11 10
Wheat Middlings (coarse) ...	94·8	12 15 0	—	11 0 0	14 5 0	13 0 0	12 10
Wheat Sharps	90·5	13 0 0	13 2 6	13 5 0	13 5 0	10 10 0	10 0
Wheat Pollards...	96·7	—	11 0 0	—	—	—	—
Wheat Bran	77·5	10 0 0	10 0 0	9 15 0	9 15 0	9 15 0	9 10
Wheat Bran (broad)	70·9	10 15 0	10 10 0	10 15 0	10 12 6	10 0 0	10 10
Feeding Treacle	60·0	12 10 0	12 2 0	—	—	13 15 0	14 0
Linseed	153·5	22 4 3	*24	23 19 3	22 15 0	—	‡26 0
Linseed Oil	250·0	40 0 0	†46 0 0	40 5 0	—	—	—
Egyptian Cotton Seed... ...	108·6	14 10 0	—	14 15 0	—	—	—
Bombay Cotton Seed	99·6	—	—	—	—	—	—
Cotton Seed Oil	250·0	—	†51 0 0	—	—	—	—
Fish Meal	125·0	—	—	—	—	12 0 0	13 0

* Cleaned. † In barrels. ‡ Crushed.

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	4½	Argentine maize ..	2	7½
Ground nut cake ..	2	0¼	English dun peas ..	2	7¾
Distillers' grains (English)	2	0½	Egyptian Cotton seed ..	2	8
Distillers' grains (French)	2	0½	Wheat middlings ..	2	8¼
Maize gluten feed ..	2	1	Wheat bran (broad) ..	2	8¼
Palm kernel cake ..	2	2¼	English maple peas ..	2	9
Malt culms	2	3	Wheat sharps	2	10½
Coconut cake	2	3¼	Linseed	2	10¾
Decorticated cotton cake	2	3¼	Egyptian cotton cake ..	3	0
Brewers' grains (dried) ..	2	3¼	Maize meal	3	0
Indian linseed cake ..	2	4¼	Egyptian rice meal ..	3	0½
English linseed cake ..	2	6	Linseed oil	3	2½
English beans	2	6½	English oats	3	3¾
Chinese beans	2	6½	Calcutta white peas ..	3	4½
Maize germ meal ..	2	6¾	Argentine oats	3	6¾
Wheat bran	2	7	Feeding treacle	4	2
American maize	2	7			

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	8¼	American maize ..	2	8
Palm kernel cake ..	2	0¼	Chinese beans	2	9¼
Distillers' grains (English)	2	1	Wheat sharps	2	10¾
Decorticated cotton cake	2	1¾	Burmese rice meal ..	2	11½
Indian linseed cake ..	2	2¼	Egyptian cotton cake ..	3	0¾
Wheat pollards	2	3¼	Maize meal	3	1½
English linseed cake ..	2	5½	Linseed	3	1½
Maize germ meal ..	2	6¼	English oats	3	1¾
Wheat bran	2	7	Bombay cotton cake ..	3	2½
Malt culms	2	7	Linseed oil	3	8¼
Wheat bran (broad) ..	2	7½	Feeding treacle	4	0½
Argentine maize	2	8	Cotton seed oil	4	1

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	Argentine maize ..	2	8¾
Brewers' grains (dried) ..	2	0¾	American maize.. ..	2	8¾
Palm kernel cake ..	2	1	Wheat sharps	2	11¼
Soya bean cake	2	2½	Maize meal	3	0
Malt culms	2	2½	Egyptian cotton cake ..	3	0¾
Wheat middlings ..	2	4	Linseed	3	1½
English linseed cake ..	2	4½	English oats	3	2¾
Wheat bran	2	6¼	Linseed oil	3	2¾
Maize germ meal ..	2	7½	Bombay cotton cake ..	3	3
Wheat bran (broad) ..	2	8¼	English dun peas ..	3	5
English beans	2	8½	English maple peas ..	3	7¾
Egyptian cotton seed ..	2	8½	English feeding barley ..	3	9¼

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake	2	0	English beans	2	7½
Distillers' grains (English)	2	0¼	Wheat bran (broad)	2	8
Maize gluten feed	2	0¾	Argentine oats	2	10
Palm kernel cake	2	2¼	English oats	2	11
Brewers' grains (dried)	2	2¾	Wheat sharps	2	11¼
Soya bean cake	2	3	Maize meal	2	11½
Decorticated cotton cake	2	3¼	Linseed	2	11½
Coconut cake	2	4	Wheat middlings	3	0
Malt culms	2	4¼	Burmese rice meal	3	0½
English linseed cake	2	5½	Egyptian cotton cake	3	1¼
Wheat bran	2	6¼	Bombay cotton cake	3	4
Maize germ meal	2	6¾	English feeding barley	3	7¾
Argentine maize	2	7¼			

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.
LONDON, LIVERPOOL, HULL AND BRISTOL.

	s.	d.		s.	d.
Brewers' grains (wet)	1	4¾	American maize	2	8
Ground nut cake	1	10¾	Wheat middlings	2	8
Distillers' grains (French)	2	0½	Egyptian cotton seed	2	8¼
Distillers' grains (English)	2	0½	Wheat sharps	2	11
Maize gluten feed	2	0¾	Burmese rice meal	3	0
Palm kernel cake	2	1½	Linseed	3	0¼
Brewers' grains (dried)	2	2¼	Maize meal	3	0½
Decorticated cotton cake	2	2¾	English dun peas	3	0½
Soya bean cake	2	2¾	Egyptian rice meal	3	0½
Indian linseed cake	2	3¼	Egyptian cotton cake	3	0¾
Wheat pollards	2	3¼	English oats	3	1¾
Coconut cake	2	3½	English maple peas	3	2¼
Malt culms	2	4¼	Argentine oats	3	2½
English linseed cake	2	5½	Bombay cotton cake	3	3¼
Wheat bran	2	6½	Calcutta white peas	3	4½
Maize germ meal	2	6¾	Linseed oil	3	4½
English beans	2	7½	English feeding barley	3	8¼
Argentine maize	2	7¾	Cotton seed oil	4	1
Chinese beans	2	8	Feeding treacle	4	1¼
Wheat bran (broad)	2	8			

TABLE VII.

GLASGOW. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Distillers' grains (dried)	1	9¼	Wheat bran (broad)	2	6½
Ground nut cake	1	10¾	English linseed cake	2	6½
Fish meal	1	11	Maize	2	8
Brewers' grains (dried)	2	1¼	Wheat middlings	2	9
Palm kernel cake	2	2¼	Rice meal	2	11
Decorticated cotton cake	2	2¾	Bean meal	3	0¾
Indian linseed cake	2	3½	Maize meal	3	0¾
Wheat sharps	2	3¾	Bombay cotton cake	3	3¼
Malt culms	2	5¼	Oats	3	3¾
Wheat bran	2	6¼	Feeding treacle	4	7

TABLE VIII.

LEITH. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	3¼	Wheat bran (broad) ..	2	7½
Distillers' grains (dried) ..	1	10½	Wheat middlings ..	2	7¾
Ground nut cake ..	2	0½	Maize	2	8
Fish meal	2	1	Rice meal	2	11
Brewers' grains (dried) ..	2	1½	Bean meal	3	0¼
Indian linseed cake ..	2	2	Egyptian cotton cake ..	3	0¾
Palm kernel cake ..	2	2¼	Maize meal	3	1½
Wheat sharps	2	2½	Oats	3	2¼
Decorticated cotton cake	2	2¾	Bombay cotton cake ..	3	3½
Malt culms	2	3½	Linseed	3	4¾
English linseed cake ..	2	4½	Feeding treacle	4	8
Wheat bran	2	5½			

TABLE IX.

AVERAGE PRICES PER FOOD UNIT.
GLASGOW AND LEITH.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	3¼	Wheat bran (broad) ..	2	7
Distillers' grains (dried) ..	1	10	Maize	2	8
Ground nut cake ..	1	11½	Wheat middlings ..	2	8½
Fish meal	2	0	Rice meal	2	11
Brewers' grains (dried) ..	2	1½	Bean meal	3	0½
Palm kernel cake ..	2	2¼	Egyptian cotton cake ..	3	0¾
Decorticated cotton cake	2	2¾	Maize meal	3	1
Indian linseed cake ..	2	2¾	Oats	3	3
Wheat sharps	2	3¼	Bombay cotton cake ..	3	3½
Malt culms	2	4¼	Linseed	3	4¾
English linseed cake ..	2	5½	Feeding treacle	4	7½
Wheat bran	2	5¾			

rations of concentrated food will be found cheap and suitable :—

I.—Palm kernel cake .. .. 1 part.
Maize gluten feed .. .. 2 parts.
Using 6 lb. for a 2-gal. cow, and 2½ to 3 lb. extra for each extra gal. of milk yielded.

II.—Linseed cake .. .. 1 part.
Palm kernel cake .. .. 1 ,,
Coconut cake .. .. 1 ,,
Using at the same rates as ration I. above.

Cattle : Feeding for Beef.—As in the case of cows, the rations suggested last month can be made slightly cheaper by replacing bran or dried brewers' grains by dried distillery grains or malt culms. In the case of malt culms 4 lb. are required to replace 3 lb. of bran or grains.

Young Stock.—In the case of young stock also, bran or dried grains may be economically replaced by distillery grains or malt culms. It may also be found advantageous to use palm

kernel cake in place of bran, in which case 2 lb. of the cake would replace 3 lb. of bran.

Sheep or Lambs Fattening on Roots.—Distillery grains or malt culms may replace bran in the rations suggested last month.

Pigs.—As pointed out last month all foods suitable for pigs are extremely dear. In districts where the finer wheat offals can still be bought at about 2s. 3d. per unit, the rations suggested last month will still be the most economical. In general, however, ground maize is cheaper than wheat offals, and the cheapest pig food is a mixture of about 5 parts of ground

TABLE X.

(1) Name of Feeding Stuff.	(2) Nutritive Ratio.	(3) Per cent. digestible: Protein.	(4) Per cent. digestible: Fat.	(5) Per cent. digestible: Carbo-hydrates and Fibre.	(6) Starch equiv. per 100 lb.	(7) Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake, Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English. } ,, ,, French }	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm kernel cake	1 : 4·5	14·1	6·1	48·9	76·7	101
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	58·2	68·4	90
Rich in Protein, Poor in Oil.						
Fish meal	1 : 0·1	54·0	2·0	—	56·0	74
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Palm-nut meal (extracted)	1 : 3·4	15·6	1·9	48·7	66·1	87
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·5	73·1	96
Wheat sharps	1 : 5·1	11·6	3·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·7	11·3	3·0	45·4	48·1	63

maize with 1 part of ground palm-kernel cake. This mixture has about the same composition as barley meal and is very much cheaper.

The suggestion made last month that unsaleable potatoes should be used for pigs proved inopportune. In view of the present scarcity of potatoes, and their consequent high price, it is unlikely that many will find their way to the pigs. In case anyone thinks of buying chats for pig food it may be worth while to point out that their food value is only about one-quarter that of ground maize. With maize at its present price of £13 per ton, or 55*s.* 6*d.* per qr., potatoes are not worth more than £3 per ton, for it would cost more to cook the potatoes than to grind the maize.

Notes on Manures in November:
From the Rothamsted Experimental Station.

DURING the coming season considerable modification will need to be made in the scheme for manuring farm crops. A high level of production is essential, and the high prices now obtaining for farm produce justify the expenditure of more money than usual on fertilisers. The situation is complicated, however, by the fact that some of the usual fertilisers are not easily obtainable, while others, though obtainable, are now being used for non-agricultural purposes, so that the price to the farmer has risen.

Another important factor in the situation is the necessity for buying early. If the fertiliser is on the farm it can be applied directly it is wanted, and there is no anxiety as to the possibility of delay at a critical time.

In these circumstances the manure produced on the farm (farmyard manure) becomes extremely important, and it is particularly necessary that it should be kept as well as possible and utilised to the best advantage. It supplies both nitrogen and potash, two constituents very much needed at the present time.

Experiments have shown that farmyard manure loses in value when clamped and exposed to the weather. It is better when kept under cover—even a temporary cover proving of value: all the field experiments agree in showing a gain in crop as the result of protecting the manure in this way. Some of the earlier experiments are described in this *Journal* for December, 1914, and later ones have fully confirmed the earlier results.

In most parts of England, especially where the rainfall is

not more than 30 in., it may not be necessary to make a clamp at all: the manure can be drawn straight out and spread wherever the land is hard enough to allow the carts to travel, and then ploughed under. This method has the double advantage of saving time at a critical period in spring, and of directly benefiting the crop. Several experiments have demonstrated this. Thus, at the Harper Adams Agricultural College,* *although the spring-manured potatoes made greater progress* at first, the yield finally came out less than that of the autumn-manured crops. At Holmes Chapel† the following results were obtained in a four years' test on loam and strong clay:—

	Potatoes.	*Swedes.*	*Mangolds.*	
Dung applied in December..	5·7 ..	14·5 ..	22·1	tons per acre.
,, ,, April ..	5·5 ..	12·8 ..	17·7	,, ,,
Advantage of winter dressing	0·2 ..	1.7 ..	4·4	,, ,,

Under wetter conditions, however, it has proved better to keep the manure in a well-made clamp till spring. Thus Berry‡ found in the west of Scotland that spring dressings on potatoes and turnips gave 50 to 60 per cent. increases, while autumn dressings only gave 25 per cent. increases over the control plots.

—	Potatoes: Increase over Unmanured Plot.			Turnips: Increase over Unmanured Plot.		
	Weight per acre.	Money Value per acre.	Per cent.	Weight per acre.	Money Value per acre.	Per cent.
	tons cwt.	£ s. d.		tons cwt.	£ s. d.	
Spring application	4 2	9 3 2	157	0 2	2 8 6	141
Autumn ,,	2 1	4 12 0	126	3 14	1 9 6	125

Nitrogenous Manures.—In view of the difficulty of forecasting events farmers would probably be well advised to lay in as much nitrogenous manure as they are likely to want during the coming season, and to allow liberal spring dressings for the corn crops. Several suitable kinds are available, sulphate of ammonia being the cheapest—the nitrogen being only a little over 15s. per unit while nitrate of soda is the dearest, the nitrogen costing over 23s. per unit. Probable prices for nitrolim are returned from several of the markets, and are about 2s. per unit dearer than sulphate of ammonia.

These prices do not show any kind of relation to the manurial value, as they are wholly determined by other considerations.

* Harper Adams Report for 1913. † Holmes Chapel Report, 1909.
‡ *West of Scotland Agric. Coll.*, Bull. No. 65, 1914.

From the farmer's point of view, if nitrate of soda is put at 100, sulphate of ammonia may usually be put at about 90, and nitrolim at about 85, when compared on a basis of equal nitrogen content. On the whole, then, sulphate of ammonia gives at present prices the best money value to the farmer.

Phosphatic Manures.—Of these the cheapest is basic slag, which is only very little above peace prices, being about 2*s.* per unit instead of 1*s.* 5*d.* Next in price come bone meal and steamed bone flour, which, though above peace prices, are, nevertheless, not high. Superphosphate, however, has risen considerably, and is now more than double its normal price: at some centres it is being mixed with a proportion of ground mineral phosphate in order to make the supply go further and keep the price steady. The dearest of all these fertilisers is dissolved bone, the soluble phosphate in which is as high as 5*s.*, even when 20*s.* is allowed for the nitrogen. At this price it is too costly for ordinary use.

Wherever basic slag will do, it is obviously the fertiliser to use. In most experiments it has given practically the same results as superphosphate. Thus, in the numerous Irish experiments it gave approximately the same results as superphosphate, both for turnips and for hay* :—

Average Yield of Turnips per Acre, 5 years, 1908-12.

Amount of Phosphate per acre.	With Dung (177 centres).		Without Dung, but with Sulphate of Ammonia and Kainit (109 centres).	
	Basic Slag.	Superphosphate.	Basic Slag.	Superphosphate.
	tons cwt.	tons cwt.	tons cwt.	tons cwt.
4 cwt.	22 17	22 19	21 18	22 11
5 ,, ...	23 9	23 16	22 17	23 12
6 ,, ...	24 6	24 9	23 16	24 12

Yield of Hay (1912 *and* 1913).

	1912 (23 centres). tons cwt.			1913 (26 centres). tons cwt.	
Superphosphate 2 cwt., nitrate of soda 1 cwt., and kainit 2 cwt. ..	3	2	....	3	1¾
Basic slag 2 cwt., nitrate of soda 1 cwt., and kainit 2 cwt... ..	3	1¾	....	2	9¾

In the Glasgow experiments† basic slag gave smaller crops of turnips than superphosphate, but the feeding value, as shown

* *Journ. Dept. Agric. Ireland,* 1914. pp. 295 (turnips) and 259 (hay).
† *West of Scotland Agric. Coll.,* Bulls. Nos. 15 and 23.

by the live-weight increase in sheep, was higher, so that on the whole the slag came out the better. In the Aberdeen experiments there was little to choose between them, but the largest crops were obtained from a mixture of the two.

On the whole bone meal and steamed bone flour have not proved as successful as superphosphate for turnips, or as slag for grass. Steamed bone flour is useful in dry situations, while bone meal has proved useful for potatoes in the place of superphosphate.

In calculating how much phosphatic fertiliser is likely to be wanted it should be remembered that potatoes and roots must have phosphates, but the crop that follows them need not. Neither of these crops actually removes much phosphate from the soil, although both need it strongly: enough is usually left for a succeeding crop. If the roots are fed on the land, however, and cake is given as well, then the succeeding barley crop may need phosphate, especially if it is in the habit of making rank growth and coming poor in quality.

Grass land, especially pasture land, needs a considerable amount of phosphate, and in many cases it has been shown that a good dressing of slag so improves the herbage that less cake is wanted: this is an extremely important consideration at the present time, when cakes are so dear.

Potash.—The standard potash manures are not yet available in quantity, though some are still to be had. Sulphate of potash is quoted to the writer at £55 10*s*. per ton. A few substitutes are coming on to the market but their value remains to be demonstrated. In the meantime, salt will serve in place of potash for certain crops, especially for mangolds and grass on light soils: it is not yet certain how far it can be used for potatoes, while in glasshouses it usually proves unsafe and sometimes has distinctly bad effects. Where much potash has been applied in the past lime may be used to liberate it, but if none has been given for some years this is not very helpful.

Fortunately dung contains a good deal of potash (some 15 lb. to the ton), and wherever it is applied it helps to make good the shortage of this constituent. Liquid manure is rich in potash and should be carefully kept.

Unit Prices of Artificial Manures in November.—The statement on p. 789 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from

	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
Nitrogen from :	*s. d.*	*s. d.*	*s. d.*	*s d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Sulphate of Ammonia pure.. 95 %	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½
93 %	—	—	—	—	—	—	—	—	—	—
Calcium Cyanamide (Nitrolim)	17 4	17 11½	—	—	—	—	—	17 2½	—	18 7
Nitrate of Soda pure 95 %	—	—	24 4½	—	—	22 10½	23 4½	—	23 6½	23 2½
.. 90 %	26 0	25 4	24 8	—	—	—	—	—	24 4	24 0
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—
Castor Meal..	—	18 9	—	—	—	—	—	—	—	—
Allowed for Potash ..	—	*26 7½*	—	—	—	—	—	—	—	—
Soluble Phosphates from :										
Superphosphate 35 %	3 4½	2 9½	3 4½	3 10½	3 7½	3 7	3 6	3 5	—	—
,, 33 %	3 4	2 11	3 5	—	—	3 6½	3 6	3 5	—	—
,, 30 %	3 4	3 0½	3 5	3 11	3 8	3 7	3 6	3 5	—	—
,, 26 %	3 8	3 3	3 8	4 4	4 0½	3 11½	3 10	3 9	—	—
Dissolved Bones.. ..	5 1½	4 10½	4 7½	—	5 1	5 3½	5 4	5 2½	5 4	5 3½
Allowed for Nitrogen	20 4½	*19 4½*	*18 3½*	—	*20 1½*	*21 1*	*21 2*	*20 7*	*21 1½*	*21 1*
Allowed for Insol. Phos.	2 9	2 7½	2 5½	—	2 8½	2 10	2 10	2 9½	2 10	2 10
Insoluble Phosphates (Citric Soluble) from :										
Basic Slag	2 9½	2 10½	2 6	—	—	2 2	—	—	—	3 0½
Insoluble Phosphates from :										
Basic Slag	—	—	1 10½	1 10½	—	2 0	—	—	—	2 6
Bone Meal	2 5	2 6½	2 5	2 4½	2 10	2 8	2 8	2 3½	2 7	2 5½
Allowed for Nitrogen	*18 1½*	*18 7*	*17 10*	*17 8*	*20 11*	*19 10*	*19 9*	*16 11*	*19 1*	*18 3½*
Steamed Bone Flour..	2 5	2 4	2 6½	2 3	—	—	—	2 1	2 4½	—
Allowed for Nitrogen	*17 8½*	*17 4½*	*18 11*	*16 9*	—	—	—	*15 6½*	*17 6½*	—
Fish Guano..	—	3 1½	2 8		—	—	—	—	—	2 3
Allowed for Nitrogen	—	*23 1*	*19 8*	—	—	—	—	—	—	*16 9*
Potash					No quotations.					

various sources, at certain ports and manufacturing centres, for November, 1916.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating, and rebagging the ingredients, bags, and loss of weight.

PARLIAMENTARY QUESTIONS AND REPLIES ON AGRICULTURAL MATTERS.

THE following questions relating to matters of importance to agriculturists have recently been asked in the House of Commons, and as the replies given to them are of general interest to agriculturists, they are printed here for their information :—

Agriculture and Recruiting.—Sir John Spear (12th October) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware that much difference of opinion exists as to the meaning of the recent instruction to tribunals respecting the non-calling up for military service of men engaged in agricultural pursuits ; whether he will make a clear statement of what is intended as far as it is possible at present to do ; and whether he is aware that the beneficial effect on food production of the instructions will be neutralised if they do not provide for such men to be left on the land for spring as well as for autumn seeding.

Mr. Acland : The arrangement provides that subject to any decision by the Man-Power Distribution Board and subject to any revision which developments of the military situation, and further information in regard to the agricultural situation, may demand, no more men from among those now employed in agriculture will, until 1st January, 1917, and, in the case of men whose whole time employment on a holding is necessary for maintaining milk production until 1st April, 1917, be called to the Colours, except in return for men released from the Colours for work at agriculture.

This arrangement provides farmers with a period of respite during which they should not only make every effort to release men who are fit for general service, but also prepare for replacing men who may be required to join the Forces later on.

The military authorities have strongly impressed on the Board that Army requirements necessitate the power of revision during January

next as regards ordinary farming, and during next April as regards dairy farming. It is impossible to indicate at the present time what modifications of arrangements may be required to meet any situation which may arise, and no guarantee can be given that the existing scale of labour allowed will not require to be revised.

Farmers will be well advised, therefore, to strain every nerve to prepare for changes which may become necessary during January and April, 1917.

Mr. Rupert Gwynne (18th October) asked the President of the Local Government Board whether, under the recent Order dealing with agricultural workers, local tribunals are to exempt men of military age whom they consider indispensable for carrying on the work of a farm until January next, or whether they should refuse further exemption from this date and leave it to the military authorities not to call them up before that date should they think it desirable?

Mr. Hayes Fisher: Under the arrangement made by the War Office and the Board of Agriculture an agricultural worker will not be called up before the 1st January, and therefore, if a tribunal is satisfied that a man should be available for military service on and after that date, they may properly decline to grant him exemption. If they are satisfied that he will be indispensable after 1st January they can, of course, give him exemption to a later date.

Control of Wheat Supply.—Mr. W. Thorne (12th October) asked the President of the Board of Trade whether he intends in any way to take control of the British wheat and flour supply, with a view of preventing the consumer from being exploited by the master flour millers and others?

Mr. Acland: The Royal Commission is at present studying the question, which has been referred to them in all its aspects, and I am unable to make a detailed statement as to their policy. They are, however, most anxious that there should be no violent dislocation of trade conditions, which would greatly increase the difficulties of getting the scheme of control into smooth working. They hope to take measures to ensure the object aimed at by the hon. Member, but they do not consider that for that purpose it is necessary to interfere with the normal supplies of British wheat.

Captain Charles Bathurst (17th October) asked the President of the Board of Trade if it is proposed to erect in this country silos or granaries for the storage of wheat imported in large quantities by the Government from overseas, or, failing such storage, whether steps will be taken to avoid placing at one time upon British markets so large an amount of grain as to cause a violent and temporary depression in its market price, resulting in a considerable shrinkage in the British wheat area due to its becoming a speculative and possibly unremunerative crop to grow?

Mr. Acland: The object of the Wheat Commission will be to ensure the regularity of supplies of wheat to this country, and beyond the maintenance of a sufficient reserve against emergencies, which has already been provided for, it is not intended either to store or to place on the market any excessive quantities.

Mr. Lough (18th October) asked the Parliamentary Secretary to the Board of Agriculture whether the proposed Royal Commission to deal with the supply and distribution of wheat will proceed by examining competent witnesses, considering evidence as to traders' difficulties

and reporting to Parliament, or whether it will set to work without inquiry on the model of the Sugar Commission; and, having regard to the importance of the proposal, whether this House will have an opportunity of discussing it before the Government monopoly is established?

Mr. Acland: The Wheat Commission has had before it a large number of representatives of the interests immediately affected and, in exercising the powers entrusted to it, will give careful consideration to the difficulties of traders. It is not taking formal or official evidence but is inquiring carefully into the various aspects of the problem. The Commission has commenced operations but a discussion of its proceedings would, in the public interest, not be advisable. I think that the public generally is willing to trust the Commission to carry out an extremely difficult task in a manner satisfactory to all the interests concerned; and I doubt whether there is at present any general feeling that at the present stage even a discussion by this House would give them material assistance.

Minimum Price for British Wheat.—Major Hunt (12th October) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the present and probable future high price of wheat from abroad, he can see his way to guarantee farmers in the United Kingdom not less than 40*s*. a quarter for eatable wheat up till 1st October next year?

Mr. Acland: In view of the present and probable price of imported wheat it does not appear that such a guarantee as is suggested is necessary as an inducement to farmers to put the largest possible area under wheat. I trust, therefore, that the nation may confidently rely on the largest area being put under wheat that the farmers' present resources will admit of.

Major Hunt (18th October) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the fact that the Government expect wheat to keep up to a price well above 45*s*. a quarter, he will now reconsider the decision not to guarantee 45*s*. a quarter for all wheat fit for bread-making till next October; and whether he is aware that the certainty of getting not less than this price would be a great encouragement to farmers to grow a larger amount of wheat?

Mr. Acland: I do not think that the hon. and gallant Member is doing a good service to British farmers in suggesting that their efforts to grow a large wheat crop depend upon the Government guaranteeing a minimum price. The business acumen and the patriotism which farmers possess will lead them to put the greatest possible area under wheat that their resources permit of, and I have every reason to believe that this as a matter of fact is being done and will continue to be done.

Substitution of other Crops for Hops.—Major Chapple (18th October) asked the Prime Minister whether his attention has been called to the fact that 307,844 cwt. of hops have been grown in England this year, and whether the Government intends to take any steps to encourage hop-growers to use their land for the production of wheat, milk, or other food of national importance and need?

Mr. Acland: The acreage under hops is somewhat reduced this year, and the importation of hops is prohibited. The production of beer is regulated by the Output of Beer (Restriction) Act. Under these circumstances the area under hops next year will only be what is required to provide home demands, and it is probably better that home demands should be thus supplied than that importation of hops should again take place. If further regulation be desirable, it should, I think, take

the form rather of regulation of output of beer than of regulation of area under hops.

Mr. Ashley : Will the right hon. Gentleman state whether the Board of Agriculture has recently been issuing special licences for the importation of hops ?

Mr. Acland : I am certain the Board of Agriculture has not, and I do not think any Department has.

Major Chapple (18th October) asked the Parliamentary Secretary to the Board of Agriculture whether he is taking any steps to encourage those who are directly and indirectly using land for the production of alcoholic beverages to divert it during the period of the War to the production of milk ?

Mr. Acland : No action has been taken in the case of the relatively small area under hops which is the perennial crop. Farmers have been urged to grow more wheat, and those who have followed the advice have, in many cases, reduced the area under barley.

Price of Milk.—Mr. Barnes (12th October) asked the President of the Board of Trade if his attention had been specially directed to the recently inflated price of milk in London ; is he aware that in certain districts the dealers are charging 6*d*. per quart, and that such price is unduly high, as proved by the fact that in other districts 5*d*. only is charged ; will he take steps to ascertain the recent increased cost of production, if any, due to increased cost of fodder and labour, and take such steps as will limit the increased cost to the consumer to such increased cost, if any, of production, and distribution ; whether he has any official information showing that milk is being withheld from the market and given to pigs ; and will he take steps, in conjunction with the Board of Agriculture to see that that practice should be made punishable ?

Mr. Runciman : I am aware that in certain London districts the price of milk has recently been raised from 5*d*. to 6*d*. per quart, the price which has been in vogue in certain other districts for several months. The Board of Trade, in conjunction with the Board of Agriculture, have been following the course of milk prices with careful attention. They have also obtained certain data regarding the cost of production and distribution, but, as stated in the report of the Departmental Committee on Prices "it is admittedly a very difficult thing to state accurately the cost of production of a gallon of milk." Several of the recommendations contained in that report deal, however, with the question of milk prices, and immediate action will be taken on these where practicable. With a view to enabling dairy farmers to meet the strain of work during the winter, the further calling up of their men for military service has been deferred, and it is expected that they will respond by offering their milk on terms which will not involve any further rise in retail prices. As regards the last part of the question, I have no information of incidents such as that described, and I do not think it can represent any general practice. If my hon. Friend will bring to my notice any such cases of which he has knowledge, I will consult my right hon. Friend the President of the Board of Agriculture as to the matter.

Mr. Barnes : Would the right hon. Gentleman say what he means by "where practicable," and might I draw his attention to a circular issued by the Christchurch Branch of the Somerset, Wiltshire and Dorset Farmers' Association in which the farmers are recommended,

if the dairymen will not come to terms to give the milk to the pigs for a time.

Mr. Runciman: No, Sir, I have not heard of that circular. If my right hon. Friend will let me have a copy of it I will inquire into it.

Mr. MacCallum Scott (18th October) asked the Prime Minister whether, in view of the rise in the price of milk, he proposes to take any steps to commandeer all supplies and to control the price and distribution, as was done in the case of sugar?

Mr. Sutton (18th October) asked the Parliamentary Secretary to the Board of Agriculture if his attention has been directed to the agitation against the increase in the price of milk which is proceeding all over the country; is he aware that the increase charged is having its effect upon the poorer classes of our large cities; and will he take steps to reduce the price of milk by the Board of Agriculture regulating the prices of the same?

Mr. Pretyman: I have been asked to reply to these questions. I am in agreement with the views expressed in the course of yesterday's Debate by speakers who represent agricultural interests, that the increases in the expenses of dairy farming have not been so great as to justify a contract price for milk higher than 1*s.* 4*d.* per imperial gallon at London stations and corresponding prices in other large towns. Outside the large towns prices should be on a lower level than this. The possibility of taking steps to secure a limitation of price to this figure without reducing the supply of milk is engaging the careful attention of the Board of Trade and the Board of Agriculture. It is hoped that dealers will succeed in resisting demands for higher prices in any purchases that remain to be made. In any case it is proposed to take immediate steps, by legislation if necessary, to carry out the recommendation of the Departmental Committee on Prices to obtain information as to milk contracts and the prices paid.

Government Purchase of Wool.—Sir J. Spear (12th October) asked the Financial Secretary to the War Office if he is aware of the resentment felt by farmers at the Government weigher of commandeered wool insisting that on every hundredweight of wool two pounds overweight must be given, contrary to all hitherto systems of wool buying; and will he order a discontinuance of this method of taking goods without paying for it?

Mr. Forster: The custom of giving "drafts" is of long standing in the wool trade, and in accordance with the promise given to observe local customs as far as possible, the War Office has not interfered with this practice wherever the local advisory committees have recommended its observance. Where the local committee has decided that drafts should be given, the price list for the area has been correspondingly adjusted so as to bring it into general agreement with prices paid elsewhere.

Mr. Ellis Davies (24th October) asked the Financial Secretary to the War Office whether he is aware that, where merchants are permitted to buy wool for their own purpose, they fix the price for the wool, which the farmer must accept as he is not free to sell to others; and whether, in view of the disadvantage to which the farmer is subjected, he will allow the farmer to sell either to the Government or to the manufacturer at his option?

Mr. Forster: Merchants are not permitted to buy wool for their own purposes, so I presume the hon. Member refers to manufacturers in the

first part of his question. Certain small manufacturers in Wales are permitted, under licence, to buy wool at the prices fixed by the Government under conditions which prevent them making any profit from the fact that the fixed prices may be less than market prices. They are not free to fix their own price, and the farmers are under no obligation to sell to them. If the farmers so desire, they can apply to the district executive officer to have their wool allocated to an authorised merchant, who will value and take delivery on behalf of the Department.

Mr. Davies: Are the farmers compelled to sell merely to the person who is nominated by the Government?

Mr. Forster: No; they can sell as they do at present, to the manufacturer who has a licence to buy, if they wish. If they do not wish to do that, or if they cannot agree on terms with the manufacturer, they can claim to sell to the Government direct.

Government Purchase of Hay.—Viscount Wolmer (17th October) asked the Secretary of State for War in what other counties the price for hay requisitioned by the Government has been the same as that fixed in Lancashire; and whether the current rates of wages and other expenses of farmers can be said to be approximately the same in these counties?

Mr. Forster: The price is the same for all counties in England and Wales, allowance being made for proximity to ports or troop centres. Lancashire farmers are exceptionally well placed in this respect, and they are not considered to be in any way penalised in comparison with farmers in other parts of the country.

Viscount Wolmer asked the Secretary of State for War what allowance has been made in the prices fixed for requisitioned hay in Lancashire for the increase in the cost of production over pre-war prices?

Mr. Forster: The price being paid is considered ample to cover all expenses and leave an average margin of profit quite equal to that under pre-war prices.

Viscount Wolmer asked the Secretary of State for War whether, in requisitioning hay from farmers, he will consider the possibility of demanding an equal percentage of all farmers' hay instead of requisitioning the entire crop of some and leaving that of others untouched?

Mr Forster: I am afraid that the Noble Lord's suggestion is impracticable. The Army Council are not now requisitioning hay from individual farmers, but have by Order under the Defence of the Realm Regulations taken possession of all hay, releasing that which is unsuitable for Army purposes.

Government Purchase of Straw.—Viscount Wolmer (17th October) asked the Secretary of State for War whether instructions have been issued to district purchasing officers concerning the 1916 crop of straw, and, if so, when they were so issued; and, if they have not yet been issued, whether he is aware that farmers' straw has been held up in Lancashire for lack of instructions?

Mr. Forster: Full instructions have been issued from time to time since 30th June last, and I am not aware that straw has been held up in Lancashire through any failure in this respect.

Waste Land, Reclamation and Forestry.—Captain Charles Bathurst (10th October) asked the Prime Minister (1) whether, in view of the vital necessity to the nation of enlarging the food area in the United Kingdom as well as the production of its existing food area, it is proposed

to carry out a scheme for the reclamation of waste land in this country; if so, whether during the War German prisoners will be employed upon this work; and (2) whether the Government have yet decided upon a scheme for the re-afforestation of the extensive areas in Great Britain which have been depleted of timber during the War and the afforestation of further suitable areas to meet future national requirements; and whether such schemes will be embarked upon, with the help of German prisoners or otherwise during the War?

Mr. Acland: As my hon. Friend knows, both the questions to which he refers are undergoing very careful and special examination at the present time. Both of them will probably require legislation before any large schemes can be set going, and, as my hon. Friend also knows, legislation affecting land is not easy. All the German prisoners for whom the War Office can provide guards and hutments are being employed in felling timber and other work, and I see no prospect at present that it will be possible to employ them in the manner suggested.

Captain Bennett-Goldney (10th October) asked the Secretary of State for War if, as it is fully recognised that scientific lumbering and forestry have been but rarely practised in this country and that British officers have therefore had but few opportunities of becoming expert in this particular work, which has now assumed such unexpected importance both in Great Britain and in the British war zones in France and elsewhere, he will place the directorate of all war-lumbering work, both at Home and abroad, under experienced and trained Canadian lumbermen and engineers, who have already proved themselves so superior in this work in this country?

Mr. Lloyd George: I fully recognise the valuable assistance rendered by the Canadian Lumbermen's Battalions in the exploitation of forests in this country and it has already been arranged for the proper co-ordination of their work, that all the battalions, whether at Home or abroad, should operate under the direct control of one expert Canadian Officer. The suggestion made by the hon. Member that all lumbering work should be put under Canadian direction is being carried out as regards the cutting of soft wood in France, though it is not considered desirable to disturb arrangements for cutting other kinds of timber in the immediate vicinity of the zone of military operations. As regards operations in this country, I have communicated the suggestion to the Home-Grown Timber Committee, who will doubtless consider it very carefully.

Mr. Duncan Millar (19th October) asked the Under-Secretary of State for the Home Department what steps have been taken by the Home-Grown Timber Committee to provide an adequate supply of timber for pit props; and if he can state the prices at present ruling for home-grown timber for use in the pits and also for imported timber?

Mr. Acland: I regret that I am not at the present time in a position to make a statement of the steps which have been and are being taken by the Committee in the matter of the supply of pitwood. I can, however, say that the Committee have purchased pitwood and have supplied it in various mining districts, and that they see no reason to apprehend a shortage of home-grown supplies. As regards price, the details are too numerous to be given in reply to a question, but the prices of pitwood, whether imported or home-grown, move together, that for the home-grown article being usually a little below that for the imported. The prices of pitwood have recently fallen.

Control of Potato Crop.—Captain Wright (19th October) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the shortage of the potato crop, he will take steps to regulate the sale and price of this food supply?

Mr. Acland: The Board are not, as at present advised, prepared to recommend the action suggested.

Importation of Canadian Cattle.—Major Chapple (18th October) asked the Secretary for Scotland whether, in the interest of agriculture and of cheaper and more abundant food, he will now consider the advisability of removing the embargo on the importation of Canadian cattle; and whether, if the possibility of the introduction of infection is still considered a danger, he will consider if isolation and supervision in Canada for a period prior to embarkation would be a sufficient protection?

Mr. Acland: The Board have very fully considered this question from time to time and do not think it advisable to relax the existing restrictions upon the importation of store cattle. I very much doubt whether the course which my hon. Friend suggests would at the present time either increase the supplies of meat or reduce the price.

Sugar and Fruit Preservation.—Mr. Butcher (17th October) asked the Chancellor of the Exchequer (1) whether he will state what proportion of the sugar supplied in 1915 to manufacturers of jam and other sugared goods is being made available for them this year; and what proportion of the sugar used by private persons in 1915 in preserving fruit will be available for their use for that purpose this year; and (2) whether he is aware that quantities of fruit in the hands of private persons are rotting and going to waste for want of sugar for preserving, and whether he will alter the mode of distribution of Government-owned and Government-controlled sugar so as to enable private persons to purchase a reasonable amount of sugar for preserving fruit and thereby to produce a cheap and valuable form of food?

Mr. McKenna: Manufacturers of jam are being allotted the amount of sugar necessary to enable them to preserve all the home-grown fruit taken by them, and certain special arrangements have been made with jam contractors to the War Office. Otherwise all manufacturers are subject to the general restriction as regards sugar supplies which the Sugar Commission have been obliged to impose in the national interest. I fear it is not administratively possible to create the machinery necessary to extend to private individuals the special arrangements made with manufacturers for preserving home-grown fruit, and I cannot say what relation in quantity the sugar supplies issued this year to the grocery trade will bear to those so issued in 1915. They are, however, not likely to exceed 75 per cent., and it is quite possible that they will not reach that amount.

Isle of Wight Bee Disease.—Sir Walter Essex (12th October) asked the Parliamentary Secretary to the Board of Agriculture whether the Board have yet discovered any cure for Isle of Wight disease in bees or whether their experiments have indicated any means for mitigating the virulence of this pest; and are there any signs other than depletion of stocks of bees in the country that the disease is showing signs of abatement?

Mr. Acland: The Board are testing a method of dealing with the disease, and the results are promising; but a final opinion cannot yet

be expressed. There is no evidence, unfortunately, that the virulence of the disease is abating.

Sir W. Essex (12th October) asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the disadvantages which in many districts of the country fruit growers are under owing to the destruction of many thousands of stocks of bees, his Board are proposing to confer with bee-keeping associations or other persons or bodies interested with a view to reintroduce legislative proposals to combat and control the vast ravages of this pest?

Mr. Acland: As it is considered impracticable during the War to deal effectively with this disease by means of legislation, the Board are of opinion that no useful purpose would at present be served by a conference such as my hon. Friend suggests. But I shall be happy to bear his suggestion in mind.

Game Preserving and Damage by Game.—Sir R. Winfrey (26th October) asked the Parliamentary Secretary to the Board of Agriculture whether he will cause inquiry to be made as to the amount of damage caused by winged and other game to the growing crops of potatoes and carrots upon the reclamation farm at Methwold, Norfolk, under the management of Dr. Edwards, acting for the Development Commissioners; and whether he will consider the advisability of suspending the Game Laws for the period of the War in order that this game may be destroyed by the tenant and the food supply from this farm thereby increased?

Mr. Acland: Some inquiry has been made into this case since my hon. Friend put down the question, and the results show that the damage by game this season on the farm is in excess of that done in normal seasons owing to the small amount of shooting which took place during the two preceding seasons. Further inquiry will be made with a view to ascertaining whether the game cannot be better kept down by those whose duty it is to do so. But as at present advised, the Board see no reason to alter their view as to the suspension of the Game Laws which was communicated to my hon. Friend in answer to a question on 27th June last.

Sir R. Winfrey (26th October) asked the Parliamentary Secretary to the Board of Agriculture whether complaints have reached him from agriculturists in the Eastern counties of the labourers being induced to leave their employment to act as beaters to shooting parties; whether he is aware of the resolution on the subject passed by the Cambridgeshire Chamber of Agriculture; and what steps he proposes to take to prevent a continuance of such practices?

Mr. Acland: The Board have received a few isolated complaints of this kind, and they are aware of the resolution to which my hon. Friend refers. As I think he already knows, the Board make a practice of inquiring into the facts in all such cases, with a view to preventing a recurrence of the cause of complaint, and this they are doing in the present instance. Generally speaking, they are satisfied that game preserving has been diminished to a very large extent indeed, and that landowners and shooting tenants are in nearly all cases subordinating their own personal interests in this regard to those of the community. Where they are not they are setting an extremely bad example, and I hope that the force of public opinion, which is the best remedy in these cases, will be brought to bear against them and be sufficient to prevent a recurrence.

Agricultural Shows and the Amusements Tax.—Mr. Flavin (26th October) asked the Chancellor of the Exchequer whether he is aware that the Listowel people are being asked to pay a tax of £32 by the Commissioners of Customs in connection with an agricultural and industrial show held in Listowel recently; whether he is aware that this show is only held for purely educational work for agricultural and industrial purposes; and whether he will see that such objects are not penalised or entirely prohibited, as they will be if this tax is enforced?

Mr. McKenna: I would refer my hon. Friend to my answers of the 20th and 26th July to the hon. Member for Queen's County. I am informed by the Commissioners of Customs and Excise that the programme of this show included driving and jumping competitions, and that they were not satisfied that the show was entitled to exemption from the Entertainments Tax. The tax is therefore payable under the law.

OFFICIAL NOTICES AND CIRCULARS.

By an Order of the Secretary of State, dated 11th October, 1916, under Regulation 11 of the Defence of the Realm (Consolidation) Regulations, 1914:

Lights to be Carried by Persons Driving Animals.

(1) Every person who shall cause or permit—

(*a*) any horse, mare, gelding, mule, ass, bull, ox, cow, heifer, steer, or calf (in this Order referred to as cattle); or

(*b*) any sheep, lamb, goat, kid, or swine

to be driven or led, during the period between half an hour after sunset and half an hour before sunrise, along any street, highway, or road to which the public have access, shall provide a lamp capable of showing a white light both to the front and to the rear, which lamp shall be carried at the rear of the animal, herd, or drove:

Provided that, in the case of an animal or animals not exceeding four in number which are being led, the lamp may be carried by the person leading the animal or animals, instead of being carried at the rear.

(2) If the herd or drove contains—

(*a*) more than 20 head of cattle, or

(*b*) more than 100 head of sheep, lambs, goats, kids, or swine,

he shall provide a second lamp also capable of showing a white light to the front and to the rear, which shall be carried in front of the herd or drove:

(3) The person in charge of the animal, herd, or drove shall see that the lamp or lamps are properly trimmed and lighted and are carried in such a manner that the light is at all times visible for a reasonable distance, without obstruction, in the direction in which the animal, herd, or drove is proceeding, and also in the reverse direction: and the person carrying any lamp shall carry it accordingly and shall, on the approach of any vehicle, swing or wave the lamp so as to indicate that there is an obstacle on the road.

The Order does not apply in the case of an animal which is being ridden or which is drawing a vehicle, or led at the rear of a vehicle, on which the lights required by law are displayed.

The Order took effect on and after 22nd October, 1916, and applies to the whole of England and Wales. It is described as the Lights (Driving of Animals) Order of 11th October, 1916.

Land Settlement of Ex-Service Men: *Acquisition of an Estate in Yorkshire.*

THE following Notice was issued by the Board on 21st October, 1916:—The Board of Agriculture and Fisheries have acquired under the provisions of the Small Holding Colonies Act, 1916, for the purpose of a land settlement colony of ex-service men, an estate of 2,363 acres near Patrington in the East Riding of Yorkshire, about 15 miles distant from Hull.

Vacant possession will be obtained at April 6th, 1917.

The soil is a rich alluvium capable of producing very heavy crops.

This colony, when fully developed, will consist of a Central Farm of about 200 acres and 60 small holdings of "mixed farming" type, averaging about 35 acres in extent. The equipment of each of the latter will include a comfortable cottage and the necessary farm buildings for carrying on the holding.

The Central Farm will be under the management of a Director and will be equipped with machinery, implements, horses, etc., which will be let out on hire to settlers requiring them. It will in the first instance embrace the greater part, if not the whole, of the estate, portions of which will be taken away from time to time for the formation or extension of the settlers' holdings.

Selected applicants will receive preliminary training by working on the Central Farm under the supervision of the Director, receiving wages until such time as they are considered capable of working a holding independently. They will then be allotted at a reasonable rental land near their cottages which, if of less extent than the average-sized holding above indicated, may be subsequently increased by taking further land from the Central Farm.

Applicants who are able to satisfy the Board that they have the necessary capital and experience may be allowed to take up holdings without preliminary training.

Settlers, even when farming on their own account, will still have the benefit of the assistance and advice of the Director of the Colony.

Co-operative methods will be adopted for the purchase of requirements and the consignment and disposal of produce.

It must be clearly understood that the Government do not propose to make direct advances of capital to ex-service men desirous of taking up holdings, but it is hoped that industrious men, even if possessed of but little capital of their own, by starting as workers on the Central Farm and at the same time cultivating a small plot on their own account, may gradually be able to increase the area under their own control until they are able to support themselves entirely from this source. Endeavours will be made to establish a system of co-operative credit to assist men of this class.

It is hoped to provide, by means of voluntary donations, a club-room and other social amenities.

In the selection of settlers preference will be given as between men of equal merit and qualifications to those whose wives or sisters or daughters, have, as the result of their employment on the land either before or during the war, acquired proficiency in milking or other farming operations.

Those desirous of becoming applicants for holdings on this colony should send in their applications without delay to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, S.W., from whom forms for this purpose can be obtained. Letters or postcards asking that forms may be sent need not be stamped.

The following Notice was issued by the Board on 2nd November :—

Wool Purchase, 1916.

Lord Crawford considers it desirable to bring to the notice of War Agricultural Committees and of agriculturists generally that, although no independent Court of Appeal has been set up to settle disputes as to the valuation of wool taken by the War Office, yet farmers and others who may be dissatisfied on any point have a right of appeal to the District Executive Officer, who will settle disputes in consultation with his local Advisory Committee.

It is also open to farmers to appeal from any decision of the Local Advisory Committee, if they so desire, to the Chief Executive Officer at the War Office (Contracts Department), Raw Materials Section, Imperial House, Tothill Street, London, S.W.

Members of War Agricultural Committees and their District Committees should report complaints of farmers and others to the District Executive Officer, or to the Local Committees.

The names and addresses of the District Executive Officers are as follows :—

List of Areas.	Centre.	D.E.O.
1. SOUTH WESTERN AREA. Cornwall. Devon. Somerset.	Exeter.	E. R. Chaffey, 47, Queen Street, Exeter.
2. WESTERN AREA. Dorsetshire. Wiltshire. Berkshire. Hampshire. Isle of Wight.	Salisbury.	W. Howarth, 34/36, Fisherton Street, Salisbury.
3. WEST MIDLAND AREA. Shropshire. Cheshire. Staffordshire.	Shrewsbury.	C. Webb, 12, Castle Street, Shrewsbury.
4. MIDLAND AREA. Bedfordshire. Buckinghamshire. Huntingdonshire. Northamptonshire. Rutlandshire. Leicestershire.	Bedford.	P. W. Paine, 15, De Pary's Avenue, Bedford.
5. SOUTH MIDLAND AREA. Warwickshire. Worcestershire. Oxfordshire. Gloucestershire. Herefordshire. Monmouthshire.	Worcester.	Kenneth Ellis, 7, College Yard, Worcester.
6. SOUTH EASTERN AREA. Kent. Sussex. Surrey. Middlesex.	Tonbridge.	H. E. Green, Brionne, Pembury Road, Tonbridge.

List of Areas.	Centre.	D.E.O.
7. EASTERN AREA. Essex. Suffolk. Norfolk. Hertfordshire. Cambridgeshire.	Ipswich.	J. B. Williamson, 1, Tavern Street, Ipswich.
8. NORTH MIDLAND AREA. Derbyshire. Nottinghamshire. Lincolnshire.	Grantham.	G. H. Mays, 18/19, St. Peter's Hill, Grantham.
9. NORTH WESTERN AREA. Lancashire. Westmorland. Cumberland.	Kendal.	W. Duncan, 73, Strickland Gate, Kendal.
10. NORTH, EAST & WEST RIDINGS. Yorkshire E. ,, N. ,, W.	Bradford.	W. Whittingham, 52, Leeds Road, Bradford.
11. NORTHERN AREA. Durham. Northumberland.	Newcastle.	R. L. MacTaggart, 52, Westgate Road, Newcastle-on-Tyne.
12. NORTH WALES. Anglesey. Flint. Carnarvon. Denbigh. Montgomery. Merionethshire.	Newtown.	A. W. Barratt, 20, Broad Street, Newtown.
13. SOUTH WALES. Glamorgan. Pembroke. Carmarthen. Brecknock. Cardigan. Radnor.	Brecon.	T. Morgan, Priory Hill House, Brecon.

Wheat Straw for Bedding.

THE War Office Forage Committee announce that the restrictions imposed upon the use of wheat straw for the bedding of animals will be withdrawn as from 1st November. The restrictions as to the prices to be paid to the producer and charged to the consumer will, however, remain as at present, and purchases will only be made of straw for which the owner is in possession of a licence to sell. It will be necessary for purchasers, as hitherto, to obtain a removal order.

No restrictions whatever exist in the case of barley, rye or rivet wheat straw. (*Board of Trade Journal*, 26th October).

Agricultural Returns of England and Wales, 1916. Produce of Crops.

PRELIMINARY statement issued on 1st November, 1916, showing the estimated total produce and yield per acre of the corn, pulse, and hay crops in England and Wales in the year 1916, with comparisons for 1915, and the average yield per acre of the ten years 1906–1915.

—	Crops.	Estimated Total Produce. 1916.	Estimated Total Produce. 1915.	Acreage. 1916.	Acreage. 1915.	Average Estimated Yield per acre. 1916.	Average Estimated Yield per acre. 1915.	Average of the Ten Years, 1906-1915.
		Quarters.	Quarters.	Acres.	Acres.	Bush.	Bush.	Bush.
ENGLAND AND WALES	Wheat ...	**6,942,559**	8,464,741	**1,912,208**	2,170,170	**29·05**	31·20	31·89
	Barley ...	**5,217,574**	4,527,929	**1,332,076**	1,231,714	**31·33**	29·41	32·79
	Oats ...	**10.461,164**	10,380,907	**2,084,661**	2,088,009	**40·15**	39·80	40·32
	Beans ...	**862,622**	804,599	**228,586**	257,055	**30·19**	27·78	29·85
	Peas ...	**260,129**	299,226	**85,266**	98,265	**24·41**	24·36	26·26
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay*	**2,899,234**	2,287,703	**1,762,699**	1,538,667	**32·90**	29·75	29·04
	Meadow Hay†	**5,937,845**	4,299,034	**4,825,988**	4,651,609	**24·61**	18·48	22·05
		Quarters.	Quarters.			Bush.	Bush.	Bush.
ENGLAND	Wheat ...	**6,764,918**	8,293,269	**1,862.211**	2,121,519	**29·06**	31·27	31·99
	Barley ...	**4,886,527**	4,229,031	**1,244.639**	1,151,536	**31·41**	29·38	32·00
	Oats ...	**9,462,989**	9,501,696	**1.862,489**	1,888,530	**40·65**	40·25	40·85
	Beans ...	**859,080**	801,098	**227,612**	256,635	**30·19**	27·78	29·86
	Peas ...	**259,038**	298,266	**84,847**	97,929	**24·42**	24·37	26·27
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay	**2,647,54**	2,080,215	**1,581,615**	1,372,922	**33·48**	30·30	29·42
	Meadow Hay	**5,324,179**	3,807,137	**4,270.042**	4,118,843	**24·94**	18·40	23·29
		Quarters.	Quarters.			Bush.	Bush.	Bush.
WALES	Wheat ...	**177,641**	171,472	**49,997**	48,051	**28·42**	28·20	27·73
	Barley ...	**331,047**	298,898	**87,437**	80,178	**30·29**	29·82	30·96
	Oats ...	**998,175**	885,211	**222,172**	199,479	**35·94**	35·50	35·43
	Beans ...	**3,542**	3,501	**974**	1,020	**29·09**	27.46	27·49
	Peas ...	**1,091**	960	**419**	336	**20·83**	22.86	23·18
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay	**251,691**	207,488	**181,084**	165,145	**27·80**	25·13	25·70
	Meadow Hay	**613,666**	491,897	**555,946**	532,766	**22·08**	18·47	20·19

* Hay from Clover, Sainfoin, and Grasses under rotation. † Hay from Permanent Grass.

NOTE.—The total production of wheat in England and Wales amounts to 6,942,559 qr., or about 1,500,000 qr. less than last year, but greater than in 1912 or 1913. The yield per acre, 29·05 bush., is about two bush. below that of 1915. Barley, although about 1½ bush. per acre below average, is better than last year, and, with the acreage increased, has given a total nearly 700,000 qr. in excess of 1915. Oats are only very slightly below the average, and slightly better than last year; the total production, 10,461,164 qr., is the largest since 1910. Beans are over average by three-tenths of a bushel per acre, and 2⅖ bush. per acre above last year, but as the area has been reduced the total production is rather below that of 1915. The yield of peas is practically identical with that of 1915, and 1⅘ bush. below average; in this case also, owing to a reduced acreage, the total production is less than in 1915.

The yield of hay from clover, sainfoin and grasses under rotation is 32·9 cwt. per acre, nearly 4 cwt. above the ten-year mean, and the third highest recorded since the returns were first collected; the total production is more than 600,000 tons greater than in 1915, and the highest since 1907. Hay from permanent grass is 1⅗ cwt. per acre above the average; the total production is more than 1,600,000 tons greater than the poor total of last year Taking both categories together, the entire production of hay is estimated at 8,837,079 tons, which is 2,250,000 tons, or fully 34 per cent., more than last year.

The estimate of the hop crop was issued on the 12th ult.; the returns of the production of potatoes and roots are collected at a later date, and will be issued subsequently.

Produce of Hops.

PRELIMINARY STATEMENT showing the estimated total production of hops in the years 1916 and 1915, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown.

COUNTIES, &c.	Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre.	
	1916.	1915.	**1916.**	1915.	**1916.**	1915.
	Cwt.	Cwt.	Acres.	Acres.	Cwt.	Cwt.
KENT · East	**53,511**	54,819	**5,326**	5,727	**10·05**	9·57
KENT · Mid.	**68,980**	68,869	**6,467**	7,238	**10·67**	9·51
KENT · Weald	**73,598**	65,646	**7,706**	8,370	**9·55**	7·84
Total, Kent	**196,089**	189,334	**19,499**	21,335	**10·06**	8·87
HANTS	**15,517**	6,131	**1,380**	1,514	**11·24**	4·05
HEREFORD	**42,821**	20,737	**4,645**	5,405	**9·22**	3·84
SURREY	**3,562**	1,628	**426**	552	**8·36**	2·95
SUSSEX	**25,816**	22,173	**2,656**	2,864	**9·72**	7·74
WORCESTER ..	**23,182**	14,469	**2,643**	2,961	**8·77**	4·89
OTHER COUNTIES* ..	**857**	137	**103**	113	**8·32**	1·21
TOTAL	**307,844**	254,609	**31,352**	34,744	**9·82**	7·33

* Gloucester, Salop and Stafford.

NOTE.—The total production of hops, 307,844 cwt., is 53,235 cwt. more than in 1915; and about 25,000 cwt. below the average of the past ten years. The average yield per acre amounts to 9·82 cwt., which is 2½ cwt. above that of 1915, and three-quarters of a cwt. above the ten years' mean.

MISCELLANEOUS NOTES.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for October, 1916, issued by the International Institute of Agriculture, contains estimates of the production of cereal crops in the Northern Hemisphere. The countries in respect of which it is possible to forecast the approximate production are as follows:—In *Europe*—Spain, England and Wales, Ireland, Italy, Norway, Netherlands, Rumania, Russia in Europe (48 governments), Switzerland; in *America*—Canada, United States; in *Asia*—British India, Japan; in *Africa*—Egypt, Tunis.

Wheat.—In the above-mentioned countries the production is estimated to amount to 278,112,000 qr. this year, against 383,781,000 qr. last year, a reduction of 27·5 per cent., the area sown also showing a decrease of 13·4 per cent.

Rye.—In the specified countries, excluding England and Wales, Rumania, British India, Japan, Egypt and Tunis, the total production is placed at 109,279,000 qr. in 1916, against 115,724,000 qr. in 1915, or a decrease of 5·6 per cent., the area sown being smaller by 4·4 per cent.

Barley.—The production in the above-named countries, exclusive of British India, is estimated at 115,674,000 qr. this year, against 127,799,000 qr. last year, a reduction of 9·5 per cent., the area sown being smaller by 3·5 per cent.

Oats.—In the above-mentioned countries, with the exception of British India, Japan and Egypt, the production is estimated at 281,439,000 qr. in 1916, or a decrease of 17·1 per cent. compared with 1915, when it amounted to 339,436,000 qr., while the area sown was smaller by 1·2 per cent.

Maize.—The production in the United States is placed at 317,000,000 qr. this year, against 356,259,000 qr. last year, a decrease of 11·0 per cent.; in Italy at 9,183,000 qr. against 14,209,000 qr., a decrease of 35·4 per cent.; and in Russia in Europe (48 governments) at 8,396,000 qr. against 9,161,000 qr., a decrease of 8·3 per cent.

Canada.—According to a report issued by the Census and Statistics Office, Ottawa, the total yield of wheat this season is provisionally estimated at 159,123,000 bush., as compared with a yield of 376,304,000 bush. in 1915; oats 338,569,000 bush, against 520,103,000 bush.; and barley 32,299,000 bush. against 53,331,000 bush. (*High Commissioner's Report*, 19th October.)

Argentina.—According to a preliminary estimate issued by the Ministry of Agriculture, the area sown with wheat this season is 16,082,000 acres as compared with 16,420,000 acres last season; oats, 2,524,000 acres against 2,565,000 acres; and linseed, 3,205,000 acres against 4,000,000 acres in 1915. (*London Grain, Seed and Oil Reporter*, 18th October.)

Australia.—The total wheat crop this season is officially estimated at 179,622,220 bush., as compared with 24,892,402 bush. in 1914–15, and 103,344,132 bush. in 1913–14. (*London Grain, Seed and Oil Reporter*, 16th October.)

Live Stock in New Zealand.—The annual statistics, up to the 30th April, 1916, report the approximate number of sheep to be 24,607,868, compared with 24,901,421 at the same period last year, or a decrease of 1·2 per cent. (*Bulletin of Agricultural and Commercial Statistics*, October, 1916.)

Agricultural Conditions in England and Wales on 1st November.

THE reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales indicate that corn generally was only secured in fair condition, and this applies more particularly to the crops that were harvested late; there were, however, many districts in which quality and condition are described as good. The harvest was a late one, and less threshing than usual has taken place, partly owing to that cause, partly owing to the unsuitable weather, and partly to shortage of labour for manning the threshing machines.

Much of the potato crop was still in the ground at the date of the reports; even in the south lifting was hardly completed, and probably quite a fourth, or more, remains to be harvested. Comparatively little disease is reported from the large Yorkshire and Lancashire potato-

growing districts; but there is much disease in Cambridgeshire and the fen lands of adjoining counties, and in the south-west, while in the south also a certain amount is reported. Early potatoes were generally satisfactory and sound.

Lifting of mangolds is generally in progress, but this work is very backward, and in some areas had hardly commenced by the end of October, while very little had been done in the case of turnips and swedes. Roots generally made good growth during October, and appear to be sound and of good quality.

The lateness of the harvest, and wet weather towards the end of October, have generally made autumn cultivation and wheat sowing very backward. The first fortnight was favourable, and much work was done during that time. Here and there reports state that wheat sowing was as advanced as usual, but such statements are exceptional. A large proportion of the area intended for wheat still remained to be sown at the end of the month, and the interruption caused by the storms rendered the prospect of a large wheat area problematical.

Seeds are everywhere, with isolated exceptions, a good plant, healthy and promising.

Live stock have done fairly well considering the rather trying weather. There is plenty of grass in the pastures, and with plenty of hay and good prospects for roots, supplies of home-grown winter keep are satisfactory, although some districts mention a shortage of straw.

Agricultural Labour in England and Wales during October.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st November, 1916, the supply of labour was generally very deficient throughout October, especially as regards horsemen and men for threshing; there were in fact statements from some districts that both horses and threshing machines have been idle from this cause. Women have been largely employed, at high wages, for lifting potatoes.

The following local summaries give further details:—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of skilled labour was very deficient, and casual labour for potato and root lifting was very scarce and dear.

Lancashire and Cheshire.—Labour was everywhere deficient, and farmers have resorted to child labour and women's work in raising potatoes, and other work on the land. The shortage of labour was expected to hinder autumn cultivation and wheat sowing, and also the lifting of turnips and mangolds.

Yorkshire.—Labour was very deficient and dear, horsemen being particularly scarce. Except for potato lifting women were not being much employed in this county.

Shropshire and Stafford.—Labour was still very scarce, and casual labour was practically unobtainable.

Derby, Nottingham, Leicester, and Rutland.—Labour was very scarce, and substitutes for men taken for the Army were very hard to obtain. In most districts the supply was barely sufficient for necessary work.

Lincoln and Norfolk.—Labour was very short, and the shortage was being especially felt among horsemen, of whom there were insufficient. Potato-lifting was being very largely done by women.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was very deficient, there being practically no casual labour available. Threshing was being delayed in consequence.

Bedford, Northampton, and Warwick.—Labour was still very scarce and temporary labour was practically unobtainable, and wages were still high. In many cases women have been helping with root lifting.

Buckinghamshire, Oxfordshire, and Berkshire.—Labour was very scarce, but the work was being done, though not so thoroughly as usual. There was a deficiency of cattlemen in south-east Oxfordshire, and of milkers in north Buckinghamshire.

Worcester, Hereford, and Gloucester.—The supply of labour was very deficient, and threshing was being delayed in consequence. Women seemed to be employed fairly extensively in some districts.

Cornwall, Devon, and Somerset.—Labour was still very scarce, and temporary labour was very difficult to obtain.

Dorset, Wiltshire, and Hampshire.—Labour was everywhere short, and temporary labour difficult to obtain. Wages were rising. Women's labour was utilised for potato raising.

Surrey, Kent, and Sussex.—The supply of labour was very deficient. The most serious shortage seemed to be among horsemen, horses having been kept idle in consequence in some cases.

Essex, Hertford, and Middlesex.—Labour was still very scarce, and the land showed signs of neglect.

North Wales.—Labour was scarce and of poor quality, temporary help especially being difficult to obtain.

Mid Wales.—Labour was abnormally deficient, but, outdoor work being almost impossible during the stormy weather, the scarcity was not keenly felt.

South Wales.—The supply of labour was very deficient, especially casual workers for potato and root lifting.

The following statement shows that according to the information in the possession of the Board on 1st November, 1916, certain diseases of animals existed in the countries specified :—

Prevalence of Animal Diseases on the Continent.

Austria (on the 27th September).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of August).—Anthrax, Swine Erysipelas, Swine Fever

France (for the period 17th September—2nd October).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—30th September).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Sheep-pox, Swine Fever.

Holland (month of September).—Anthrax, Glanders, Foot-rot, Swine Erysipelas.

Hungary (on the 27th September).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 2nd—8th October).—Anthrax, Black-leg, Foot-and-Mouth Disease (1,457 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of September).—Anthrax, Blackleg, Swine Fever.

Russia (month of June).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (72,057 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of June).—Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of September).—Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period 2nd—8th October).—Anthrax, Blackleg, Foot-and-Mouth Disease (4 "étables" entailing 28 animals, of which 4 "étables" were declared infected during the period).

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Serbia, Rumania.

The Weather in England during October.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.	Rainfall. Amount.	Rainfall. Diff. from Average.	Rainfall. No. of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 7th Oct.:								
England, N.E. ...	54·1	+3·7	0·90	23	+10	6	1·7	−2·0
England, E.	56·6	+5·2	0·56	14	− 1	5	2·3	−1·6
Midland Counties ...	55·9	+5·5	1·22	31	+15	6	2·1	−1·4
England, S.E. ...	58·4	+5·5	1·29	33	+15	6	2·0	−1·9
England, N.W. ...	55·5	+4·5	2·09	53	+29	6	0·9	−2·3
England, S.W. ...	55·4	+6·1	2·35	60	+35	7	1·2	−2·6
English Channel ...	60·0	+4·3	1·15	29	+ 7	7	1·2	−3·3
Week ending 14th Oct.:								
England, N.E. ...	56·4	+7·7	0·43	11	− 6	4	2·7	−0·7
England, E.	58·6	+8·8	0·22	6	−10	3	2·7	−0·9
Midland Counties ...	57·9	+9·3	0·30	8	− 9	4	2·2	−1·1
England, S.E. ...	60·2	+9·1	0·14	4	−14	3	1·3	−2·3
England, N.W. ...	56·6	+7·0	1·53	39	+15	5	1·7	−1·2
England, S.W. ...	59·1	+8·2	0·46	12	−14	4	1·0	−2·5
English Channel ...	59·9	+5·5	0.09	2	−20	3	2·0	−2·2
Week ending 21st Oct.:								
England, N.E. ...	44·4	−3·0	0·28	7	−12	4	3·6	+0·6
England, E.	45·6	−2·7	0·58	15	− 2	4	3·4	+0·1
Midland Counties ...	45·3	−1·8	0·42	11	− 6	4	4·1	+1·1
England, S.E. ...	47·6	−1·9	0·84	21	+ 2	3	4·2	+0·8
England, N.W. ...	46·7	−1·6	0·49	13	− 9	4	3·7	+1·0
England, S.W. ...	49·4	−0·1	0·62	16	−10	4	3·3	0·0
English Channel ...	53·2	0·0	0·61	15	− 8	4	4·9	+0·9
Week ending 28th Oct.:								
England, N.E. ...	45·5	−0·9	0·57	14	− 5	6	2·4	−0·3
England, E.	47·1	0·0	0·62	16	0	5	2·7	−0·3
Midland Counties ...	44·9	−1·0	1·06	27	+10	6	2·9	+0·4
England, S.E. ...	48·7	+0·1	1·63	41	+21	6	3·2	+0·1
England, N.W. ...	45·8	−1·2	1·16	29	+ 7	7	2·8	+0·3
England, S.W. ...	48·7	0·0	2·43	62	+36	7	3·2	+0·3
English Channel ...	51·0	−1·2	2·34	59	+36	7	3·7	+0·2

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	45	31	453	477
Animals attacked	55	34	536	542
Foot-and-Mouth Disease:—				
Outbreaks	—	20	1	20
Animals attacked	—	234	24	234
Glanders (including Farcy):—				
Outbreaks...	2	1	44	41
Animals attacked	10	2	112	73
Parasitic Mange:—				
Outbreaks	59	59	1,849	703
Animals attacked	95	122	4,098	1,513
Sheep-Scab:—				
Outbreaks	8	2	205	166
Swine Fever:—				
Outbreaks	210	242	3,803	3,450
Swine Slaughtered as diseased or exposed to infection	105	892	8,910	14,937

The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	—	3	1
Animals attacked	—	—	7	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	2	5	58	64
Sheep-Scab:—				
Outbreaks	39	27	366	346
Swine Fever:—				
Outbreaks	18	22	277	219
Swine Slaughtered as diseased or exposed to infection	84	131	1,696	1,256

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in October and September, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	October.		September.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	13 3	12 8	14 0	13 6
Herefords	13 2	12 0	13 9	12 6
Shorthorns	13 3	12 1	13 8	12 6
Devons	13 7	12 2	13 10	12 3
Welsh Runts	12 10	12 0	13 2	12 2
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	—	10¾	11¼	10½
Sheep :—				
Downs	12¾	11½	12¾	11½
Longwools	12	11	11¾	10¾
Cheviots	13½	12¼	13½	12½
Blackfaced	12¾	11¾	13¼	12
Welsh	11½	10¼	12	11
Cross-breds	12¾	11¾	12¾	11¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 11	12 3	13 0	12 3
Porkers	13 9	13 2	13 8	13 1
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	37 18	30 3	37 2	30 4
,, —Calvers ...	34 16	29 4	36 5	29 12
Other Breeds—In Milk ...	33 8	27 2	35 7	26 16
,, —Calvers ...	28 0	25 0	27 0	25 0
Calves for Rearing	3 8	2 15	3 8	2 14
Store Cattle :—				
Shorthorns—Yearlings ...	15 5	13 3	14 13	12 11
,, —Two-year-olds...	22 3	19 2	22 1	18 8
,, —Three-year-olds	27 13	24 10	27 12	24 12
Herefords —Two-year-olds...	24 12	19 13	21 7	18 11
Devons— ,,	22 15	19 7	21 15	18 9
Welsh Runts— ,,	21 2	18 8	21 15	18 1
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	56 7	48 9	54 1	46 0
Store Pigs :—				
8 to 12 weeks old	33 2	25 5	36 5	28 2
12 to 16 weeks old	52 6	40 10	54 6	42 6

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in October, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—											
English	1st	86	0	86	0	—		86	6	82	0
	2nd	81	6	83	6	—		81	0	79	6
Cow and Bull	1st	77	6	80	6	73	0	77	0	74	6
	2nd	70	6	73	0	63	0	71	6	68	0
Irish: Port Killed	1st	—		83	6	82	0	84	0	80	0
	2nd	—		81	0	76	6	78	6	76	0
Argentine Frozen—											
Hind Quarters	1st	80	6	—		—		—		—	
Fore ,, ...	1st	67	6	—		—		—		—	
Argentine Chilled—											
Hind Quarters	1st	88	0	88	0	84	6	87	6	84	6
Fore ,, ...	1st	71	6	71	6	70	0	71	6	70	6
Australian Frozen—											
Hind Quarters	1st	—		—		—		—		—	
Fore ,, ...	1st	—		—		—		—		—	
VEAL :—											
British	1st	104	0	—		107	6	116	6	—	
	2nd	97	0	98	0	99	0	98	0	97	0
Foreign...	1st	—		—		—		—		—	
MUTTON :—											
Scotch	1st	106	6	—		109	6	116	6	109	6
	2nd	102	6	—		102	6	108	0	105	0
English	1st	107	6	112	0	—		112	0	105	0
	2nd	104	0	107	6	—		102	6	100	6
Irish: Port Killed	1st	107	6	—		99	0	102	6	102	6
	2nd	102	6	—		94	6	95	6	98	0
Argentine Frozen	1st	84	0	78	0	79	6	81	0	78	6
Australian ,, ...	1st	82	0	—		—		—		—	
New Zealand ,, ...	1st	82	0	—		—		83	0	—	
LAMB :—											
British	1st	108	0	115	6	113	0	120	6	115	6
	2nd	105	6	108	6	101	0	111	6	111	0
New Zealand	1st	95	6	98	0	95	0	92	6	95	0
Australian	1st	—		—		—		—		—	
Argentine	1st	88	0	85	6	85	0	85	6	85	0
PORK :—											
British	1st	121	6	114	6	116	6	123	6	119	0
	2nd	115	6	107	6	107	6	109	6	105	0
Frozen	1st	93	6	97	6	100	6	102	0	95	6

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in October, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	21 6	20 6	—	—	21 3	20 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	200 6	197 0	199 0	196 6	200 6	196 6
,, Factory	183 6	174 0	185 0	177 0	184 6	178 6
Danish...	—	—	210 6	208 6	210 6	206 0
French...	—	—	—	—	184 0	180 0
Dutch	—	—	—	—	195 0	191 0
American	—	—	186 0	182 0	187 0	181 0
Canadian...	195 6	191 6	194 0	192 0	196 6	192 6
New Zealand	203 6	199 6	—	—	200 0	196 0
Argentine	—	—	—	—	197 0	193 6
CHEESE:—						
British—						
Cheddar	119 6	110 6	120 6	115 0	122 0	115 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	129 0	124 0	131 6	125 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	112 6	109 6	113 0	110 0	112 6	110 0
BACON:—						
Irish (Green)	119 6	116 0	116 0	113 6	116 0	111 6
Canadian (Green sides)	109 0	107 0	109 6	105 6	109 0	105 0
HAMS:—						
York (Dried or Smoked)	162 6	156 6	—	—	164 0	157 0
Irish (Dried or Smoked)	—	—	—	—	152 0	146 0
American (Green) (long cut)	109 6	105 6	111 0	105 6	108 6	104 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	—	—	—	—	26 10	25 0
Irish	23 4	—	22 10	20 10	24 9	23 6
Danish	—	—	—	—	26 0	24 0
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen... ...	157 6	145 0	—	—	172 6	162 6
Edward VII.	170 6	153 0	161 6	153 6	160 0	150 0
Up-to-Date	158 6	145 0	155 0	146 6	168 0	158 0
HAY:—						
Clover	—	—	150 0	140 0	148 6	138 6
Meadow	—	—	—	—	148 6	138 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 8 ...	30	11	46	2	55	8	25	11	29	7	47	8	18	4	26	5	31	5
,, 15 ...	31	0	48	9	59	7	20	0	30	5	48	6	18	6	27	6	31	11
,, 22 ...	30	11	51	6	57	2	26	3	31	3	49	6	18	11	28	10	32	6
,, 29 ...	31	1	52	8	58	0	26	6	32	5	51	0	19	1	29	10	32	11
Feb. 5 ...	31	0	53	3	58	3	26	7	33	7	52	5	18	9	30	3	32	4
,, 12 ...	31	0	54	8	57	6	26	7	34	7	52	10	18	11	31	1	32	2
,, 19 ...	31	0	56	0	56	11	26	7	34	11	53	6	18	11	31	5	31	9
,, 26 ...	31	0	56	0	58	2	26	6	35	3	54	2	18	11	31	8	32	2
Mar. 4 ...	31	5	55	11	59	4	26	2	34	6	55	7	18	9	31	8	32	4
,, 11 ...	31	6	54	8	58	2	26	0	33	5	55	6	18	7	31	0	32	3
,, 18 ...	31	5	53	9	57	9	25	8	32	2	55	4	18	6	30	7	31	10
,, 25 ...	31	4	54	3	55	11	25	7	31	11	54	6	18	8	30	6	31	4
Apl. 1 ...	31	6	54	6	53	6	25	6	31	9	53	8	18	5	30	6	30	5
,, 8 ...	31	5	54	9	51	8	26	8	31	3	53	7	18	4	30	4	30	1
,, 15 ...	31	7	55	4	53	2	25	4	30	10	53	1	18	4	30	5	30	7
,, 22 ...	31	9	56	5	55	3	26	6	31	5	52	10	18	5	30	11	31	8
,, 29 ...	31	9	58	3	56	3	26	0	32	7	53	5	18	5	31	5	32	4
May 6 ...	32	2	60	5	55	7	25	6	33	3	53	1	18	9	32	4	32	10
,, 13 ...	32	7	61	7	55	5	26	3	34	0	53	5	18	11	32	5	33	1
,, 20 ...	33	0	62	0	55	0	25	10	34	1	52	10	19	0	32	8	33	0
,, 27 ...	33	9	61	11	54	7	26	1	34	8	52	9	19	4	32	7	33	4
June 3 ...	34	0	61	9	53	3	25	11	35	4	53	9	19	4	32	5	33	3
,, 10 ...	34	1	60	1	51	2	24	11	34	5	52	8	19	8	32	4	32	7
,, 17 ...	34	1	56	1	48	10	25	10	34	3	50	9	19	9	31	9	32	1
,, 24 ...	34	3	52	0	47	6	25	4	34	4	49	10	20	0	31	9	31	3
July 1 ...	34	4	49	5	46	3	24	6	35	3	49	1	19	9	31	1	30	10
,, 8 ...	34	2	50	1	46	3	24	9	34	7	45	6	20	0	31	6	30	8
,, 15 ...	34	1	52	7	48	11	24	2	35	8	47	5	19	10	31	6	31	6
,, 22 ...	34	0	53	10	51	6	24	7	35	10	48	8	19	9	32	1	32	3
,, 29 ...	34	2	55	3	53	5	25	9	36	1	47	2	19	8	31	1	32	5
Aug. 5 ...	34	9	55	4	55	1	25	2	35	7	46	1	19	1	31	5	32	9
,, 12 ...	40	3	55	2	56	7	29	4	37	0	46	11	25	1	31	7	31	2
,, 19 ...	38	9	54	3	58	1	29	10	39	4	48	0	24	3	31	4	30	8
,, 26 ...	36	2	51	11	59	0	30	3	38	3	47	1	23	5	30	0	31	6
Sept. 2 ...	36	5	45	3	59	4	30	6	38	1	48	5	23	9	26	10	30	5
,, 9 ...	37	10	43	0	59	3	29	11	37	11	51	7	23	11	26	8	31	1
,, 16 ...	38	3	42	9	59	11	29	5	39	0	52	6	23	8	26	4	30	9
,, 23 ...	37	6	43	3	59	4	29	3	39	8	53	3	23	3	26	1	30	9
,, 30 ...	37	1	43	5	58	10	29	1	40	4	54	1	22	9	26	5	31	1
Oct. 7 ...	36	8	44	1	59	2	28	10	41	0	54	5	22	5	26	5	30	9
,, 14 ...	36	7	45	9	59	7	28	8	42	3	53	10	22	4	27	1	31	6
,, 21 ...	37	2	48	2	60	9	28	7	44	0	53	8	22	5	28	1	31	11
,, 28 ...	37	10	50	3	62	10	28	3	46	2	54	6	23	7	29	1	32	10
Nov. 4 ...	38	8	51	6	66	7	28	6	47	3	56	2	23	7	30	4	34	0
,, 11 ...	39	8	52	8	69	8	29	0	47	5	58	0	24	8	30	11	35	0
,, 18 ...	41	0	53	6			29	8	47	11			25	5	31	3		
,, 25 ...	41	11	54	2			30	3	48	7			25	8	31	1		
Dec. 2 ...	42	2	53	7			30	2	48	11			25	9	30	11		
,, 9 ...	42	1	52	10			29	11	47	10			25	9	30	4		
,, 16 ...	42	7	53	11			29	8	47	5			25	9	30	6		
,, 23 ...	43	3	53	10			29	9	47	2			25	11	30	7		
,, 30 ...	44	4	54	9			29	10	47	5			26	6	30	10		

NOTE.—**Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.**

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of October, 1914, 1915, and 1916.

—	Wheat.						Barley.						Oats.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	38	10	48	2	63	7	29	8	45	5	55	4	24	4	29	8	33	8
Norwich ...	36	9	45	4	57	9	28	3	42	8	52	6	22	9	27	8	31	1
Peterborough	36	6	46	4	60	3	29	5	43	11	53	11	22	9	27	7	31	8
Lincoln ...	36	1	46	8	60	1	29	11	43	6	53	9	22	3	27	11	30	7
Doncaster ...	35	7	46	0	59	2	27	0	41	4	51	9	21	8	26	11	31	2
Salisbury ...	37	7	46	8	60	11	29	4	41	2	54	10	23	0	27	5	31	2

NOTICES OF BOOKS.

International Yearbook of Agricultural Legislation.—The International Agricultural Institute has issued, for 1915, its International Yearbook of Agricultural Legislation. The body of this voluminous work of some 1,500 pages is in French and is divided into 11 sections giving account of the legislation in 41 countries affecting: (1) agricultural and commercial statistics, (2) trade in agricultural products, machinery, manures and live stock, (3) finance and customs in relation to agriculture, (4) crops and vegetable products industries, (5) live stock breeding and animal products industry, (6) agricultural organisation and education, (7) plant diseases, weeds and plant pests, (8) agricultural co-operation, insurance and credit, (9) rural property and closer settlement, (10) relation between capital and labour in agriculture, and (11) rural hygiene and rural police.

In an 80-page introduction, in English, the legislative changes forming the subject of the volume are sketched in their main outlines. The legislation regarding agriculture in the various countries has, of course, dealt principally with the conditions created by the War, and it is interesting to compare the measures taken by these countries. The volume includes a survey of the legislation in Germany affecting supplies, prices and consumption of agricultural products.

There are two good indexes (in English) to the volume, arranged according to (1) country, (2) subject.

The price of the volume is 7*s.* 11*d.* Remittances should be forwarded to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

The Geology of Ben Nevis and Glen Coe and the Surrounding Country.—The Board of Agriculture and Fisheries desire to give notice that a Memoir descriptive of the geology of the Ben Nevis and Glen Coe district of the Highlands has already been issued by the Geological

Survey of Scotland in explanation of Sheet 53 of the One-inch Scale Geological Map.

This is a wild and mountainous region mostly devoted to sheep-farming and to sport, but well known to tourists from the surpassing beauty and variety of its scenery. The geological structure as described in this Memoir is of excessive complexity and very difficult to unravel. Ben Nevis, which long proved a difficult problem to geologists, is shown to be the sunken stump of a volcano with granite rising through the old volcanic ashes and lavas. The Glen Coe district is also volcanic and is described as a "cauldron" into which the rocks have subsided. Rivers, lakes and glens have their history expounded as fully as the evidence allows, and a chapter is added on the economic mineral products and the books and papers which have been published on the geology of the area.

Copies may be obtained through any bookseller, price 7*s*. 6*d*., from Messrs. T. Fisher Unwin, Ltd., 1, Adelphi Terrace, London, W.C., or from the Director-General, Ordnance Survey Office, Southampton.

Progress of the Geological Survey of Great Britain.—The Board of Agriculture and Fisheries desire to give notice that the Summary of Progress of the Geological Survey of Great Britain for 1915 has recently been published This volume gives an account of the work of the Geological Survey for the past year.

In England and Wales on the North Wales border, work has been continued to the southern termination of the Denbighshire coalfield, and the mapping of the neighbourhood of Shrewsbury has been commenced. Progress has been made also in the surveying of the older rocks on the one side, and of the Triassic rocks on the other side of the coalfield. In Warwickshire the study of the uppermost division of the Coal Measures has led to important results bearing on the depth and resources of the productive measures. In Staffordshire an area hitherto believed to be overspread by Bunter now appears to be mainly occupied by these uppermost Coal Measures. The productive measures may be more accessible than was supposed.

In Scotland progress has been made on several points bearing on the future development of coalfields. The complicated structure round Auchterhead Muir has been elucidated, and exploratory boreholes in the concealed coalfield of Central Ayrshire have been investigated.

There are also appendices dealing with (1) a deep boring for coal near Little Missenden, Bucks., and (2) a Catalogue of Types and Figured specimens of British Cretaceous Gasteropoda preserved in the Museum of Practical Geology.

Copies may be obtained through any bookseller from Messrs. T. Fisher Unwin, Ltd., 1, Adelphi Terrace, London, W.C., who are the Sole Wholesale Agents to the Trade outside the County of London; or from the Director-General, Ordnance Survey Office, Southampton. Price 1*s*.

Women's War Work: The War Office, foolscap, 94 pp., 72 photographs. September, 1916. (*London:* Wyman & Sons, Ltd.; *Cardiff:* Wyman & Sons, Ltd.; *Edinburgh:* H.M. Stationery Office (Scottish Branch); *Dublin:* E. Ponsonby, Ltd.; *Agencies in the British Colonies and Dependencies, the United States of America, and other Foreign Countries:* T. Fisher Unwin, Ltd., London, W.C.; 1*s*. net.

This volume contains information officially compiled for the use of recruiting officers, military representatives and tribunals as to the work of women in maintaining the industries and export trade of the

United Kingdom. Part I. furnishes an index of trades (including agriculture) in which women are successfully employed in temporary replacement of men, a detailed list of processes, and separate information as to munitions work. Part II. gives photographs of women workers actually engaged on war work. The agricultural section illustrates harvesting, the care and grooming of horses, feeding a threshing machine, etc. Part III. provides lists of officials likely to be of assistance in the problem of substituting woman labour, and includes the Board of Trade Women Agricultural Organising Officers, and the Honorary Secretaries of the County Women's Farm Labour Committees.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Wilson, J.—A Manual of Mendelism. (152 pp.) London: A. & C. Black, 1916. 2*s.* 6*d.* net. [575.1.]

Russia, Department of Agriculture.—Industrie Agricole en Russie. (257 pp.) Petrograd, 1914. [63(47).]

Vendelmans, H.—The Manual of Manures. (164 pp.) London: "Country Life" Offices, 1916. 3*s.* 6*d.* net. [63.16(02).]

Carlyle, Mrs. E. H., and *Falkner, Lt.-Col. P. H.*—First Lessons in Poultry-keeping. (64 pp.) Adelaide House, Glenageary, Co. Dublin: Mrs. Carlyle [1916]. 2*s.* net. [63.651(02).]

Atkins, W. R. G.—Some Recent Researches in Plant Physiology. (328 pp.) London: Whittaker & Co., 1916. 7*s.* 6*d.* [58.11.]

Armstrong College.—College Bull. 13:—Manures and Feeding Stuffs and their Present Supply. (8 pp.) Newcastle-upon-Tyne, 1916. [63.1625; 63.604(*a*).]

Michigan Agricultural Experiment Station.—Tech. Bull. 24:—The Freezing Point Method as a New Means of Measuring the Concentration of the Soil Solution Directly in the Soil. (44 pp.) East Lansing, Mich., 1915. [63.113.]

Hoering, P.—Moornutzung und Torfverwertung, mit besonderer Beruecksichtigung der Trockendestillation. (638 pp.) Berlin: J. Springer, 1915, 12 M. [63.142; 662.6.]

Bangor, University College of North Wales, Department of Agriculture.—Bull. 7:—Spraying of Charlock in Corn: Spraying of Potatoes, 1915. (8 pp.) Bangor, 1916. [63.259; 63.24-33.]

University of Leeds and Yorkshire Council for Agricultural Education.—Bull. 101:—Suggestions as to the Manuring of Crops in the Spring of 1916, with Special Reference to the Use of Sulphate of Ammonia. (8 pp.) Leeds, 1916. [63.16(04).]

Field Crops—

Armstrong College.—College Bull. 15:—Grass and Clover Seeds, with Notes on the Grasses and Clovers grown in the Northern Counties. (9 pp.) Newcastle-upon-Tyne, n.d. [63.33(*b*).]

Bengtson, N. A., and *Griffith, D.*—The Wheat Industry: For use in Schools. (341 pp.) New York: The Macmillan Co., 1915. 3*s.* net. [63.311: 38.]

Aberystwyth, University College of Wales, Agricultural Department.—The Improvement of Upland Pastures. (24 pp.) Aberystwyth, 1916. [63.33-16.]

Plant Diseases—

Petherbridge, F. R.—Fungoid and Insect Pests of the Farm. (174 pp.) Cambridge: University Press, 1916. 4*s.* net. [63.2(02).]

Reading, University College, Faculty of Agriculture and Horticulture.—Bull. XXVI.:—A Plant Disease Survey of the County of Middlesex. (82 pp.) Reading (1916). [63.292(42).]

Veterinary Science—

U.S. Department of Agriculture, Office of the Secretary.—Circ. 58:—Reports upon the Federal Meat Inspection. (10 pp.) Washington, 1916. [614.31.]

(4661) Wt. P. 13—50. 7,500. 11/16. J. T. & S., Ltd.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE

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DECEMBER, 1916.

FRENCH AGRICULTURE AND THE WAR.

The Cultivation of Abandoned Lands.—In an article in this *Journal* for April last on the French Agricultural Labour Problem an outline was given (p. 16) of a Bill of the French Ministry of Agriculture of February, 1916, for the cultivation of abandoned lands. The Bill was amended and did not become law until 6th October.

Requisition of Land.—The law provides that in the case of uncultivated lands the mayor of each commune, assisted by two municipal councillors, will, if it is necessary, invite the owner or habitual cultivator to bring these lands under cultivation. If the cultivator, within 15 days, does not justify his abandonment of the lands by reasons other than his own unwillingness, the mayor can requisition the lands and hand them over to the communal committee of agricultural action* to be cultivated. Where the cultivator admittedly finds it impossible to cultivate the lands (either in whole or part) the mayor is empowered to arrange, with the cultivator's help, for the management of the lands.

The Ministry of Agriculture points out that the law will only be rigorously applied to owners or cultivators who do not wish to make any serious effort, and who through idleness and selfishness leave their lands fallow. The mayor will be the judge of the reasons for the abandonment of the lands. It is anticipated, however, that the recalcitrant will be very small in number, and that the law will apply principally to those who wish their lands cultivated but are unable to carry on the work.

The duty is not imposed on the municipality of cultivating *all* abandoned lands, but only such as it chooses and as are within its means. The management of these lands can be handed over to the prominent agriculturists of the commune who compose the committee of agricultural action.

* See *Journal*, April, 1916, p. 15.

The law is to be applied in a spirit of persuasion and not in a spirit of force, which may compromise the results. Whenever possible requisition is to be consented to rather than imposed. There are (1) the mobilised cultivators (owners or farmers) who have left no one behind, and owners whose farmers or metayers have gone before the expiry of their lease: these cannot but be grateful for the cultivation of their lands. (2) There are holdings partially abandoned from lack of means of cultivation: these represent an enormous area, and committees of agricultural action and municipalities are to give them their whole attention and efforts.

Requisition of Stock.—To carry out agricultural work, even on land continuing under cultivation, the law provides that the mayor can requisition machinery, implements, premises, and animal and mechanical traction available *in the commune. The forms and limits of requisitions and compensation* are to be determined by prefectoral decrees approved by the Ministry of Agriculture.

Mares and cows kept for breeding (as well as for draught purposes) cannot be requisitioned as draught animals, but can only be used with the free consent of the owner.

Communes are authorised under the conditions specified below (Financial Arrangements) to acquire implements and motors useful for cultivation. Such as are already in the commune will only be requisitioned in default of friendly hiring, and with due regard to the needs of the owners from whom requisitioned.

Agricultural permissionaires* are to have the right to travel free both going and returning.

The Ministry of Agriculture explains with regard to this section that the committee of agricultural action would be condemned to inaction if the municipal councils did not procure them all kinds of resources—money, carts, machines, etc. Draught animals, machines and agricultural implements can be requisitioned for the purpose in the commune if the owners have no need of them, and the commune can buy or even hire machines. Special attention is called to the *use of tractors* because the Ministry of Agriculture gives a grant of one-third of the cost, or one-half of the cost in devastated districts.

The law is silent on the question of labour, but the military authorities are to be approached unceasingly to obtain the aid of labour in all forms: permissionaires, gangs, flying gangs, agricultural companies, guards of the means of communication

* *Journal*, April, 1916, p. 9.

and prisoners of war; and exemption must be secured for agricultural specialists: farriers, repairers of agricultural machines, threshers, and workmen and technicians in agricultural distilleries and sugar works. The position will be quite different when the voices of the municipalities and committees of agricultural action are substituted for those of isolated, powerless agriculturists.

Financial Arrangements.—The law provides that the commune is to assure the expenses and loans for the work. The sums demanded by the communes in this connection will, after approval of the Commission for Agricultural Credit, be paid them by the Ministry of Agriculture through the medium of the district banks and out of the general agricultural credit funds.* The district banks are to receive interest at 1 per cent. per annum from the communes. The communes' acceptances will be payable at the latest at six months after harvest. At maturity of the bills the prefect must, if required by the district banks, inscribe this credit on the list of sums to be recovered from the commune (as in the case of direct taxes). In any case the district bank will not be responsible to the State for loans contracted by it as the State's intermediary.

In explaining these financial arrangements the Ministry of Agriculture states that the lack of money is one of the most important reasons for the abandonment of lands. The *district* credit banks are used because a large number of agriculturists forming the *local* banks have been mobilised, and the directors and staff being mobilised the offices could not be kept open, nor could the propagandist work, now necessary, be undertaken. If to the 1 per cent. charged by the district banks under the Act is added a slight commission of the municipality to cover cost of management and risk, the committees of agricultural action should obtain loans at $1\frac{1}{2}$ to 2 per cent.

Allocation of Profits or Losses on Working.—The provision of the law as to division of net profits is as follows: if the holding is that of a mobilised man or his family, $\frac{7}{10}$ths goes to him, $\frac{1}{5}$th to the commune, and $\frac{1}{10}$th to the State's agricultural credit funds (*via* a special account in the district bank); if the holding is that of a non-mobilised man or his family, one-half goes to him, $\frac{3}{10}$ths to the commune, and $\frac{1}{5}$th to the State, paid in the same way as before.

In the case of loss: after the accounts have been approved by the municipal council and have been proved, no action,

* An account of the structure of the French Agricultural Credit System will be found in the *Journal* for January, 1911, p. 844, and March, 1913, p. 1036.

either individually or collectively, as to responsibility or presentation of accounts will lie against the mayor, the municipality, or the cultivators substituted. The loss will be borne as follows: if the holding is that of a mobilised man or his family, $\frac{1}{5}$th by the commune, $\frac{4}{5}$ths by the agricultural credit funds (*via* the district bank); if the holding is that of a non-mobilised man or his family, $\frac{3}{10}$ths by him, $\frac{1}{5}$th by the commune, and the remaining half by the agricultural credit funds. The commune is to collect any losses from cultivators by adding the amount to the taxes collected from them. No rent will be due to owners of requisitioned lands when the cultivation of these lands leaves a loss.

In explaining the above provisions to the directors of agricultural services the Minister of Agriculture makes the statement that "the communes are completely secured from a financial point of view. To cover expenses of cultivation they have the crops obtained, and these are almost always sufficient for the purpose. Where a profit is made the law allows them to share it. The rate charged them by district banks on loans is infinitesimal—1 per cent. If there is a loss, despite all these factors, the State will bear the major part, and only an insignificant part will remain to be borne by the commune—which will be more than compensated for by the profits made on the whole."

Return of Requisitioned Lands if desired.—The law provides, finally, that lands requisitioned or placed under cultivation by the committee of agricultural action may be returned after requisitioning or placing under cultivation, if the owner or holder desires it and guarantees the commune the expenses and loans in connection therewith.

In the following pages an attempt has been made to bring up to date the information given in this *Journal* for April last with regard to the various sources from which agricultural labour is being recruited in France.

Prisoners of War.—Throughout 1915 there was no organised plan for the distribution of prisoners for work in agriculture, though prisoners were used for agricultural and forest improvement, and were sent to private cultivators whenever they were asked for. For this reason the aid given from this source to agriculture in different districts was very unequal.

At the end of 1915 requests for prisoners for agricultural work became more numerous. New supplies were obtained from the Ministry of War and distributed between departments requesting them. By July, 1916, the Ministry of Agriculture

was seeking to obtain a greater equilibrium in the distribution of prisoners, and did not cease to urge the claim of agriculture for a due share in contingents of prisoners set free for civil work by the Ministry of War.*

In general, a much more judicious use of prisoners was made by the Agricultural Labour Office of the Ministry of Agriculture in 1916 than in 1915; the prisoners were first sent to the departments producing most hay for work on the hay harvest, then to the corn-growing districts for work on the corn harvest, next to the departments of the south and south-west for the viticultural work, and lastly they were employed on lifting sugar beet. Until next spring it is intended to use them on cultivations, in distilleries and sugar works, and in cutting timber.

By the close of the summer of 1916 the organisation of the work of prisoners in agriculture was excellent. The number available was increased from 15,000 at the beginning of the year to 35,000 at the end of summer, and the help they have given to French agriculture in the present crisis has been undoubtedly great. The Ministry of Agriculture receives demands for prisoners through the prefects, who indicate the total needs of their departments and, with the aid of sub-prefects, mayors and directors of agricultural services, distribute the prisoners among arrondissements and cantons.

The chief deterrent to the use of prisoners by private agriculturists was the fact of having to employ 20 men, and it was therefore urged that agriculturists should have the right to employ very small groups, proportionate to the importance of their holdings. Their wishes were so far deferred to that at the end of June, 1916, the Minister of Agriculture made it known that if arrangements could be made between the prefect and the general commanding the district, the minimum of 20 prisoners could be divided into groups of five so that cultivators of small and average sized holdings might employ them. Generals commanding districts were instructed to divide the gangs of 20 into separate groups of five during working hours, the prisoners only being brought together again at night. The desirability of small holders co-operating to make use of such prisoner labour was insisted on.

French agricultural interests are continuing to press for an increase in the number of prisoners placed at the disposal of agriculture, and there is at present (November) under discussion

* At the beginning of April, 1916, the Minister of War decided to withdraw prisoners from Algeria for use in France.

the question whether the groups of five prisoners should not be further sub-divided into units.

A Presidential decree of 13th July, 1916, appointed a committee to examine the question of the employment of prisoners of war; the Ministries of War, Marine, Public Works, Trade, Labour and the Interior, as well as the Ministry of Agriculture, are represented on the Committee. The principal points under examination by the Committee with regard to agriculture are those of housing and the use of very small groups.

An account of the employment of prisoners of war on a small scale with very satisfactory results was given to the French Academy of Agriculture in June, 1916. Other kinds of labour being non-existent, or having proved unsuccessful, the Agricultural Syndicate of Beauregard (Dordogne) obtained a gang of 20 prisoners. The syndicate consisted of 220 members, mostly small cultivators employing but few workers. To ensure the full employment of the gang, four members of the syndicate bound themselves to take the prisoners for the minimum time allowed (a week), being persuaded that the other cultivators would profit by the labour. The idea of these members was to create a kind of depot from which all members could draw labour.

There was no difficulty in housing the prisoners, an isolated farmhouse, fenced round, being available and providing adequate eating, cooking and sleeping accommodation for the 20 prisoners and their eight guards. The gang contained a German officer who did not work; but this proved an advantage rather than otherwise, since he proved a good supervisor and did not hesitate to punish his men in case of need.

The executive committee of the syndicate meets every fortnight to pass accounts; demands for prisoners are met in the order in which they are received. Only demands for 6, 12 or 18 prisoners are accepted, so that the guards may be utilised to the best advantage. The local farmers, male and female, have become interested to such an extent that ten more prisoners have had to be obtained, national antipathies and fears of underpaid foreign labour have been overcome, crops have been harvested satisfactorily and the viticultural situation saved, and in an area of some 17,500 acres there is practically no abandoned land.

Reckoning all charges, and allowing six days per month for unemployment, the syndicate offers the labour at 3 fr. 10 c. per man per day, or 4 fr. per day if the work is at a considerable distance.

Foreign Labour.—After the declaration of war by Portugal, some Portuguese labour seems to have been used for viticultural work in France.

Between March, 1915 (the date of the creation of the Agricultural Labour Office), and October, 1916, some 55,350 Spanish labourers entered France for agricultural work, with 700 women and 7,500 children. French employers are now obliged to deposit £3 per labourer with the governor of the province of origin of the labourer as security for his return to Spain. The Agricultural Labour Office has set up immigration offices at Marseilles, Bordeaux and a few other places.

Employers of Spanish labour are stated to have had a real grievance in many cases. It has been found that, after the expenses of recruitment and travelling have been paid by the employer, the Spaniard has left to enter the service of another cultivator—a process which has been helped by the fact that the first cultivator cannot offer such high wages as he has to recoup himself for his expenditure. The remedy suggested to the Agricultural Labour Office is to make the new employer bear the whole or part of the costs of obtaining the labour.

Indo-Chinese labour has been used for agricultural work; there is, however, a feeling among agriculturists against the introduction of Chinese on account of the unassimilability of the race.*

A decree of 14th September, 1916, is designed to ensure the immediate recruitment of 17,500 Algerian labourers by means of voluntary or *compulsory* enlistment. These men are to be regarded as civil labourers and will not participate in military operations; and they are to be distributed by a special office—the Colonial Worker's Office under the Ministry of Labour. The decree bears the signatures of the Ministries of the Interior, War and Labour, but not that of the Ministry of Agriculture, though it appears that agriculture will be able to draw supplies from this source.

In September last the Ministry of Labour was considering the establishment of departmental employment exchanges serving at the same time for industry, commerce and agriculture. The claim of the Ministry of Labour to control the recruitment of agricultural labour has raised a storm of protest from agricultural interests; it is feared that agriculture will suffer in comparison with industry by reason of the lower,

* A proposal was made in November that recruitment committees should be set up in Shanghai and Tien Tsin to obtain Chinese agricultural labourers for France. The Ministry of War have been voted credits to enable foreign labourers to be obtained for French war factories, the proposed numbers including 30,000 Indo-Chinese and 10,000 Chinese.

more variable, and not easily standardised wages, the more difficult organisation of gangs, the seasonal nature of the work and its liability to interruption, and the greater difficulty of the housing problem, and it is pointed out that a knowledge of the requirements of agriculture and of the special aptitudes necessary in applicants is peculiar to the Ministry of Agriculture. The agricultural committee of the French Chamber of Deputies recommend a special organisation for the purpose under the Agricultural Labour Office; and the French Academy of Agriculture in July passed a resolution to the effect that the recruiting of agricultural labour should be exclusively carried out by the Agricultural Labour Office under the control of the Ministry of Agriculture, and by the Agricultural Associations.

The Work of Soldiers—Agricultural Permissions and Gangs.—It appears that 440,000 individual permissions were granted between 1st November, 1915, and 1st February, 1916.

The position of permissionaires was defined by a circular of the Ministry of War of 2nd April: (1) agricultural permissions asked for by mobilised agriculturists were not to be refused without plausible motive; (2) agricultural permissions were not to be refused so as to get the man into a gang, and individual permissions, sending the man to his own holding, were much to be preferred to using him in a gang; while gangs were only to be formed of agriculturists who did not desire permissions, those returning from permission, and the non-agriculturists; (3) permissions were not to be refused on the pretext that the man is not an owner, labourers being equally eligible; (4) useless formalities were to be done away with, all that has to be produced being a certificate of the mayor of the commune establishing that the man is an agriculturist—and mayors give these certificates to the men on their own personal responsibility.*

To ameliorate the working of permissions the Ministry of War had, in each department, set up an "Agricultural Labour Commission," composed of the prefect, the general commanding (or his delegate), and the director of agricultural services; and the communal committees of agricultural action served as intermediaries between these commissioners and agriculturists

Then, in July, to put an end to hesitation, delays, and even default,' in connection with permissions, the Ministries of

* Abuses crept into the use of these certificates and in June additional safeguards were imposed. These in turn soon proved so unworkable that they were withdrawn and the simple certificate of the mayor reintroduced.

Agriculture and War set up a "higher control" consisting of a representative of each Ministry, to watch over the granting ot permissions and with full power to settle litigious questions immediately and assure the carrying out of ministerial circulars. Later in the year a divisional general seems to have been working in each district under this higher control, assuring himself that permissions and exemptions (see later) were granted in conformity with ministerial instructions. Whether owing to these measures, or from other causes, it is certain that the attitude of depot commanders had changed very much from the uncompromising position taken up by them at the outbreak of war; in October, 1916, they were receiving the demands of cultivators very favourably, and a large number of them were zealous in forming the gangs to be placed at the disposal of prefects for use in the best interests of the local agricultural production.

With regard to the classes of troops to whom agricultural permissions are granted, auxiliaries, territorials, and territorial reserves in the interior zone seem to have enjoyed them throughout; agricultural soldiers in garrison in the Army zone, if they do not belong to a formation under the orders of the Commander-in-Chief, also have permissions, as also do guards of the means of communication. Men liable to be sent as reinforcements to an active or reserve army corps during the summer of 1916 did not get permission after 1st July, and, similarly, men who were liable to be so sent as reinforcements had the right to permissions stopped for one month previously to being sent. A vacillating policy seems to have been pursued as regards the agriculturists of the 1917 class. Permissions were at first refused to this class, but the restriction was afterwards withdrawn to enable both these men and non-agriculturists of the class together with instructors of the class to help in harvest work.

Other classes who have been given permissions are convalescent and unfit, hospital attendants (these seem on occasion to have had very little hospital work to do) and *even agriculturists employed in munition factories.*

In August the French Chamber of Deputies adopted a motion giving permissionaires the right to free travel both going and returning, and a clause to this effect is inserted in the law relating to the cultivation of abandoned lands (see above). A concession as to travelling expenses has also been made in respect of the gangs (not to be confused with the flying gangs). If these are suddenly recalled before they have stayed eight

days the total cost of transport will be borne by the State; if they are recalled after the eight days, however, the State pays the cost of the return journey only.

Spring Work.—In March, 1916, arrangements were made for the help of soldiers in spring work. More than 100,000 soldiers (30,000 in the army zone and 70,000 in the interior zone) were placed at the disposal of agriculture for some weeks, and were employed through the medium of the prefects and of communal committees of agricultural action. At the same time permissions of one month were granted to 2,500 cultivators spread over the different departments, and flying gangs were also in use (*i.e.*, the employment of bodies of troops in large numbers for a day or half a day in the districts round cantonments).

Towards the middle of April the Minister of War asked generals commanding districts to give agricultural permissions until 1st May to all agriculturists of the 1917 class desiring this, and to form the non-agriculturists into gangs.

Then on 10th May the Minister gave instructions that the flying gangs system must be developed by authorising the men to work with neighbouring cultivators not only for half a day but even for periods of two or three days, and as frequently as military necessities permitted; even men likely to be sent to the front as drafts were to be utilised until the last minute. It must be explained that in many departments the troops are dispersed throughout the department in numerous cantonments, so that this measure was more important than appears at first sight.

Hay Harvest.—The wishes of the military coincided with those of agriculturists as to the ingetting of the hay, since the 1915 crop was short, while the crop of 1916 was apparently a good one. Permissions were largely granted, much use was made of flying gangs made up of men of classes who were not allowed permissions, and gangs of non-agriculturists were placed at the disposal of the departmental Commissions of Agricultural Labour. Each agriculturist who obtained a permission of 15 days could, after expiry of the period, place himself for an equal period at the disposal of the Committee of Agricultural Action, making an absence of 30 days in all.

Provision was next made for gangs of territorials to be placed, up till 1st July, in the army zone at the disposal of beet growers, arrangements as to employment being made by the prefects.

Corn Harvest and Exemptions.—In connection with corn harvest the question of granting exemptions for various periods was considered. The Chamber of Deputies had already demanded, on 9th June, and been granted, exemption for territorial reservists who were agriculturists or belonged to allied professions, until the end of harvest, this being equivalent to a permission of 3 months instead of 15 or 30 days. Besides cultivators the exemption applied to smiths, farriers, "mechanicians," repairers of agricultural machinery, and threshing machine owners and attendants. A census was carried out of all such "professionals" capable of taking part effectively in the work (those whose exemptions would not directly affect agriculture were excluded) the census being carried out by a commission in each department. Lists were also drawn up of the needs of the departments for such men, and were sent to the generals commanding districts. These lists were used in the case of repairers of agricultural machines, farriers and threshers,* and interested persons did not have to make a personal demand as in the case of permissions (or, it seems, in the case of ordinary cultivators exempted for the harvest).

In addition to other sources of labour for the corn harvest, the 1917 class, if agriculturists, were given permissions of 15 days, the non-agriculturists and instructors of the class being formed into gangs. The ordinary permissions were limited to the 15 days, probably as a *quid pro quo* for the concessions obtained from the army as to exemptions.

Viticultural Work.—Special provision was made for viticulturists. They were allowed permissions on the same conditions as ordinary cultivators, but for the purpose of controlling cryptogamic diseases the Ministry of Agriculture obtained for them the right to several permissions of four days each fortnight; a schedule showing the dates and duration of the viticultural harvest in the various departments was drawn up for the purpose by the Ministry of Agriculture. For the harvest proper, permissions of 20 days between 20th September and 20th October were given to territorials and certain exempted men, and to other viticulturists with the Colours, so far as was compatible with military needs; coopers were given permissions of 30 days, and, in addition, gangs, prisoners and horses were placed at the disposal of viticulturists.

* 1,500 threshers alone seem then to have been exempted—500 for a month at a time

A circular of the Ministry of War of 26th September, 1916, making provision for the aid of the army in ***autumn work***, insisted on the fact that women farmers who have been left alone on holdings of 25–75 acres must have experienced male help for this work. The officer members of the Agricultural Labour Commission of the department must ask the civil authorities for particulars of such holdings, and must then place at the disposal of these women for a convenient period one or two men, as often as possible from the same or neighbouring districts, and chosen from agricultural labourers who have no agricultural work of their own to do.

Children.—Efforts have even been made in France to organise the work of children in agriculture. A circular issued by the Ministry of Education in June, 1915, pointed out to parents and school authorities that legally, beside holidays, an absence of three months annually from school could be obtained; and that when applications for such absence were for the purpose of engaging in agricultural work they were to be favourably considered and liberally granted. Such concessions were obtained from that time onwards. It was recognised that the studies of children would suffer, but it was hoped that the consent of parents might be got to the prolongation of study at the termination of the war.

The department of Loire furnishes an example of the use of school children. The attention of teachers here was called to a note of the director of agricultural services of the department pointing out that, properly supervised and directed, children's labour could be a great help in agriculture: "Boys and girls of 10 years can turn hay and rake it into heaps, leaving the more difficult work for their elders . . . They are just as useful at corn harvest; wheat sheaves must be collected into stook, and children can carry them and thus assist in earlier harvesting. For less urgent work in fruit or vegetable growing districts the small hands of children are a great help. Their labour can quite well be used in planting potatoes, hoeing of all kinds, viticultural work, and clearing thistles. For these purposes the school children, either isolated or in groups, can be placed at the disposal of cultivators or their wives, under the supervision of teachers." The use of the children elsewhere was directed when they were no longer required by their parents. Pupils of urban schools situated near the agricultural districts were also, if possible, to be used.

The Minister of Education was followed by the Minister of Labour, who addressed a circular to prefects asking them to

use the labour of young people during their holidays for national defence purposes and particularly for agricultural work.

As a result of a special appeal some very good harvest work seems to have been done by enthusiastic Paris students.

Horses and Machinery.—The procedure regulating the loan to agriculturists of army horses and mules was standardised by a circular of the Ministry of War of 18th March, 1916. This circular provided that horses and mules of troop depots in the interior zone were to be lent to agriculturists; that demands were to be addressed to the commandants of the depots and were to be recommended by the mayor of the commune; that the loan was to be limited to a maximum of 60 days, but renewals were allowed; and that in the case of exceptional depreciation of the horses or mules an indemnity was to be paid by the borrower.

There was some discontent where cultivators had to travel long distances to the troop depots merely in order to renew the loan, and the question was raised in the Chamber of Deputies as to whether domiciliary visits could not be arranged in such circumstances. The answer of the Minister of War was that such renewals were necessary to avoid prolonged loan and the consequent establishment of a right to the horses, and further that there was frequent necessity for shoeing.

Since the outbreak of war the Ministry of Agriculture and other bodies have conducted trials of motor-cultivating machinery in various districts of France; it is impossible, however, to deal here with the results.

In 1915 the Ministry of Agriculture decided to set aside a sum of £11,600 for distribution between co-operative cultivation societies who bound themselves to buy machinery for use on their own and, if need be, on their neighbours' lands.* The first subvention (of £160) was given to a syndicate formed for the purpose in January, 1916, at Mossais, near St. Maurice. The syndicate consisted of eight members farming 580 acres, one-third of which consisted of compact clay land. The syndicate bought a 25-h.p. tractor, costing £528, with a three-furrow plough costing £56. The total cost of £584 (less £160 subsidy) was divided among the eight cultivators in proportion to the arable area of each. The expenses are estimated at the end of each month and are paid by those who have used the machine in that month in proportion to the work done; depreciation is allowed for on the basis of a life of eight years. The order of use of the machine is decided by lot, except that

* See also p. 818.

on the decision of the director, the more compact clay lands must be cultivated first in fine weather.

The French Society of Agriculture also encouraged the formation of co-operative societies by promising a grant of £80 to each of the first five formed.

The agricultural associations of Haute Garonne have organised a syndicate to study questions relating to motor cultivation, and to encourage the formation of motor societies; £1,200 was voted for the purpose.

In April, 1916, the Government decided that motor-cultivation machinery should be considered as munitions of war for the purpose of facilities of transport. To encourage the continuation of motor trials the Compagnie des Chemins de Fer du Midi granted free transport to apparatus and personnel, and offered a prize of £40 to be shared between two constructors who should invent an apparatus for vine cultivation. The Compagnie Paris-Lyons-Méditerranée decided to grant from 1st August, 1916, a subvention to all syndicates of mechanical cultivation who bought apparatus for collective use; the subvention was to be equal to 10 per cent. of the cost of the apparatus, with a maximum of £40 per apparatus comprising tractor and plough, and only 30 subventions were to be granted. Further conditions were that the apparatus must be delivered before 31st December, 1917, and that half of the zone of the operations of the syndicate are served by the Paris-Lyons-Mediterranean railway.

By a decree of 23rd October a commission was appointed to promote the use of agricultural machinery among French agriculturists.

Soldiers' Gardens and Cultivation behind the Trenches.—Reference has already been made in this *Journal* (July, 1916, p. 401) to the admirable gardens created by soldiers around cantonments, and to the instructions of the Ministry of War that kitchen gardens and even small fields should be brought under cultivation, wherever possible, round cantonments by soldiers. It was stated last August that, as a result, military gardens were by then organised in all districts occupied by troops. The 1st Zouaves, *e.g.*, cultivated at that date 82,000 square metres (20½ acres) of gardens consisting of military property and of plots given by public bodies and private individuals. Most of the plants and seeds were obtained free, while some farmers lent ploughs, and horses were lent by the artillery. The smallest garden worked by this regiment—that at St. Denis, of 4,000 sq. metres (about 1 acre)—was

formerly uncultivated land, but is now under cabbages, carrots, beans, tomatoes, potatoes, etc., and this result has been obtained without a man being taken from military work and without detracting from the labour of gangs supplied by the regiment (see elsewhere). The 26th battalion of Chasseurs à Pied in their garden at St. Maur with an expenditure of £6 for implements and seeds, harvested £120 worth of vegetables. The results round Paris have been so satisfactory that it is intended next year to extend the gardens and keep pigs, poultry and rabbits. The soil round fortifications has been found very fertile, having lain so long fallow.

Cultivation by the French army in the military operations zone varies according to whether the districts have been evacuated by the inhabitants or not. The evacuated districts are those nearest the trenches and are often under fire. Here, in certain army corps or divisions, agricultural companies have been formed, of variable size and constitution, but usually divided into groups (under a N.C.O.) comprising from six to ten men, together with horses. Only the sector of the front occupied by the corps or division is cultivated, but the cultivation goes as near the trenches as possible. The agricultural implements in evacuated villages have in some cases been kept and repaired; otherwise the implements and seed are furnished from the rear by the director of agricultural services. The cultivation is mainly extensive and limited to cereals, potatoes and fodder crops; no account is taken of farm boundaries.

In inhabited districts farther from the trenches the army corps have in some cases proceeded as if the districts were evacuated; in other cases the cultivators or municipalities have been helped with contingents of soldier labour (flying gangs), distributed according to the demands of mayors, with horses, carts, seeds, manures and implements. Here there is no difficulty about the rotation, farm boundaries are observed, and the farmers generally direct the work.

Instances of army corps cultivation have been given in the French agricultural press. In one case, where a unit arrived in November, 1915, out of eight communes behind the trenches, but under fire, four were completely evacuated, two had a few cultivators and two could be considered as containing representatives of all holdings, though without carts and labour. In the uninhabited communes the army provided all the labour, and the land to be cultivated was divided into two parts with a two-yearly rotation. In the communes with a reduced population the army corps supplied all the labour wanted, but an agricultural committee was formed to arrange the rotations.

In the inhabited communes carts were lent and the initiative was left to the farmers, under military control. An officer was chosen for each commune to organise the labour. Machines and implements which had lain in the fields for 14 months were sent to the rear and repaired, with an estimated saving of £4,000. Similarly, in the arrondissement of Verdun all agricultural implements which could be saved from evacuated districts were transported to the rear, repaired, and used by troops in the hay and cereal harvests.

REPORT ON SEEDS PURCHASED IN CENTRAL AND SOUTH WALES: SEASONS 1915-16.

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SEED testing for farmers in the Aberystwyth College area was started on a comprehensive scale in the spring of 1913, when a special effort was made to obtain a large number of representative samples.

A report was published early in 1914 dealing with the state of the seed trade as revealed by the 370 analyses then made; and subsequently a statement was issued on the 205 samples received during 1914.*

It is now proposed to take the inquiry a stage further, and deal with the samples tested during 1915–16. At the request of the Board of Agriculture and Fisheries an endeavour was made in 1916 to obtain representative samples from all the counties of South Wales, so that the results might be embodied in this report. Professor C. Bryner Jones, therefore, through the kindness of Messrs. W. J. Grant and J. C. Newsham, obtained some additional samples from Monmouth, and through the courtesy of Mr. Hedger Wallace a few samples were also received from Glamorgan: 270 samples were tested in 1915, and 394 in 1916. The number of samples received from the several counties for the two years together was approximately as follows:—

Cardigan 246, Radnor and Brecon (together) 121, Montgomery 111, Pembroke 66, Monmouth 40, Merioneth 39, Carmarthen 36, and Glamorgan 5.

The results obtained are fairly generally applicable to all

* *The Condition of the Seed Trade in the Aberystwyth College Area*, February, 1914, and *Report on Seeds Tested at the Aberystwyth College Agricultural Department*, Season 1914; both issued by the Agricultural Department of the College.

the above counties except Glamorgan (from which the number of samples received was small): seed of every grade was met with from all the other counties.

It is interesting to note that since the appearance of the first report several co-operative societies and local seedsmen have sent their seeds to be tested at the College, five of the former and nine of the latter having done so during 1915-16; and whereas 14 farmers sent their seeds in 1914, samples were received from 33 in 1915, and from 47 in 1916.

It is a remarkable fact, however, that co-operative societies, local merchants and farmers alike do not seem to realise the importance of having their root and grain seeds tested, the great majority of samples coming to hand being grasses and clovers.

TABLE I.—*Summary of Results for* 1915.

Samples.	Number of Samples.	Average Germination.	Average Impurity.	Highest and Lowest Germination.	Highest and Lowest Impurity.
		Per cent.	Per cent.	Per cent.	Per cent.
		THE CLOVERS.			
Red clover and cow grass—					
Welsh	10	86·6	2·4	97—58	8—0·4
English	6	92·0	1·2	98—86	2—0·5
Not designated ..	44	90·9	1·0	99—60	4—0
Alsike clover—					
Canadian	1	98·0	1·3	—	—
Not designated ..	28	88·2	1·7	97—54	11—0
White or Dutch clover—					
English	1	97·0	0·2	—	—
Not designated ..	19	83·3	4·4	96—55	21—0·1
Trefoil	11	92·8	1·0	99—83	2·8—0
Yellow suckling clover..	4	87·2	0·3	94—83	0·6—0·2
		THE GRASSES.			
Perennial rye-grass ..	39	88·2	2·2	98—65	9—0·1
Italian rye-grass ..	23	82·0	0·7	96—78	3—0
Cocksfoot	24	80·8	—	96—50	—
Timothy	16	93·1	0·3	100—64	2—0
Meadow fescue ..	7	89·3	—	98—56	—
Crested dogs'-tail ..	1	98·0	—	—	—

The results of the analyses are summarised in Table 1 (for 1915), Table 2 (for 1916), and Table 3 (for the less important species and species received in small number only, for the two years together).

In order to facilitate discussion of the individual species it will be well first to make a few observations on the following closely-related subjects: (1) Impurities; (2) Place of origin of the sample; and (3) Price. These are points on which special emphasis is laid in the summary at p. 843.

1. **Impurities.**—These, whether weed seeds or dirt, are always objectionable, as they take the place of the seed required. It is however, the quantity of weed seeds, or of seeds of useful plants cheaper than the sample required, which are present, which usually materially influences the value of the sample. In the tables, therefore, the percentages of weed and other seed impurities are given instead of the absolute purity, as is usual.*

TABLE II.—*Summary of Results for* 1916.

Samples.	Number of Samples.	Average Germination. Per cent.	Average Impurity. Per cent.	Highest and Lowest Germination. Per cent.	Highest and Lowest Impurity. Per cent.
		THE CLOVERS.			
Red clover and cow-grass—					
Welsh	27	83·5	1·9	95—50	11—0·3
English	13	89·1	1·1	99—57	2—0·1
Not designated	58	90·2	0·7	98—59	2·7—0
Alsike clover—					
English	3	91·0	1·7	96—87	2·6—1·2
Canadian	4	92·2	0·6	95—88	1·2—0·1
Not designated	29	85·8	2·0	98—55	9·6—0
White or Dutch clover—					
English	4	86·6	2·6	98—74	5·9—0·3
Not designated	22	84·1	2·7	98—55	10·2—0·1
Trefoil	21	85·5	0·5	99—64	1·3—0
Yellow suckling clover	6	85·0	0·3	88—80	0·8—0·1
		THE GRASSES.			
Perennial rye-grass	47	90·2	1·4	97—48	8—0·2
Italian rye-grass	26	85·8	1·6	96—55	7—0·1
Cocksfoot	34	81·1	—	97—30	—
Timothy	28	94·0	0·9	100—61	10—0
Meadow fescue	10	91·4	—	98—70	—
Crested dogs'-tail	12	90·8	—	97—77	—

In the 1913 report it was emphasised that, with regard to weed seeds, *what matters as much as, and frequently more than, their amount, is their kind.* Biffen† has also laid stress on this point, and recent work has more than ever convinced the present writer of the justice of his earlier remarks.‡ Impurities may from this point of view be classified as (*a*) Land-fouling and destructive, (*b*) Decidedly harmful, and (*c*) Slightly harmful.

* In discussing seed questions with farmers, the statement that a sample contains, say, 2 per cent. of weeds appears to give more food for thought, than to speak of such a sample as being 98 per cent. pure. The former mode of expression emphasises the *impurity*, the latter the relative purity.

† This *Journal*, Vol. xxii, No. 11, February, 1916: *Report on an Inquiry into the Quality of Farm Seeds*, 1912–14, R. H. Biffen, M.A., F.R.S.

‡ During the last two years opportunity has presented itself of visiting several fields sown down with seeds of various grades, that have passed through the writer's hands.

(*a*) *Land-fouling and Destructive.*—Dodder is *the* destructive impurity to be guarded against. The ordinary Clover Dodder has been met with in fields at over 500 ft. above sea level; the South American species has, however, only been found growing at low elevations and on good land, and is therefore not so often a serious destructive impurity. The Lesser Broom-rape,* although unusually abundant on fields in Mid-Wales this season, has not been found in a single sample of clovers tested (1913–16). The essentially land-fouling impurities are those which, even if introduced in small amounts only, will readily establish themselves and increase in the fields rapidly from year to year, despite competition with the sown grasses

TABLE III.—*Summary of Results for 1915–16 (together). For Samples received in small numbers only.*

Samples.	Number of Samples.	Average Germination. Per cent.	Highest and Lowest Germination. Per cent.
	CLOVERS, ETC.		
Lucerne	1	85·0	—
Bird's-foot trefoil	1	95·0	—
Kidney vetch	4	66·0	93—20
	GRASSES.		
Tall oat grass	5	63·0	92—27
Tall fescue	4	74·5	91—67
Fine-leaved fescues	3	76·0	82—70
Meadow foxtail	1	67·0	—
Rough-stalked meadow-grass	7	85·2	95—80
Smooth-stalked meadow-grass	5	76·2	80—70
	OTHER HERBAGE PLANTS.		
Chicory	1	75·0	—
Burnet	1	72·0	—
Sheep's parsley	1	60·0	—
Ribgrass	4	70·5	76—65
	CEREALS.		
Wheat	3	77·0	98—56
Oats	4	84·5	93—76
Barley	8	86·8	95—73
	ROOTS.		
Mangolds	5	82·5	115—50
Swedes	10	93·5	98—88
	OTHER PLANTS.		
Cabbage	5	81·2	98—50
Onion	5	52·0	70—35
Rape	3	95·3	99—90
Linseed	4	91·6	98—80
Vetch	1	98·0	—

* See this *Journal*, Vol. xv., No. 3, June, 1908, pp. 176–180; Vol. xxiii., No. 5, August, 1916, p. 478, and No. 6, September, 1916, p. 598; and Leaflet No. 226 (*Broom-rape*).

and clovers. They are weeds which, if not sown as impurities, might never make their appearance in a field, or at least would not secure such an abundant or rapid hold on the ground.

Weeds which may be fairly placed in this category are Docks, Wild Carrot, Thistles, Yorkshire Fog, and Soft Brome.* The inclusion of seeds of this order is more serious when fields are put down to leys of long duration (the commonest practice where most of the seed under review is used) than when left to "seeds" for one or two years only.

(*b*) *Decidedly Harmful.*—Weeds in this group are of very general occurrence on grass land and even if not introduced as impurities may, nevertheless, become abundant. If sown in any quantity, however, they are likely to attain to greater prominence, and to be more harmful in the early years of a ley than they would be solely as indigenous plants. To this class belong Cat's-ear; Soft Crepis (often very plentiful in a first year's hay crop); Self-heal; Sheep's Sorrel (particularly on peaty or other acid soils where it may completely ruin a young ley); Ribgrass (a ubiquitous weed of grass land, the wide distribution of which is probably accounted for in many districts by the large quantity of the seed frequently found in clover samples); and in some localities the Geraniums (which on the Cotswolds, and elsewhere, are sometimes abundant on pastures of moderate age). All the above are serious impurities in a mixture, especially if the seeds are sown in corn which "goes down" or if for any other reason the "take" is a bad one.

(*c*) *Slightly Harmful.*—The slightly harmful weeds are (i.) those which do not occur to any extent on older leys, and if introduced will only be a nuisance on the ley for one or two years: in most districts the Geraniums, Bladder Campion, Field Forget-me-not, Field Madder, and *Caucalis* spp. may be regarded as belonging to this class; (ii.) To the foregoing might be added the Mayweeds, Spurrey and Redshank—weeds which may appear subsequently on the arable land; (iii.) Trefoil, Yellow Suckling Clover, and poorly-harvested Rye-grass caryopses, in Red Clover, and Perennial Rye-grass in Cocksfoot should also be included in this class.

In general it may be said that the "land-fouling and destructive" weeds are serious if present in samples to the extent of 0·5 per cent., or even less; that the "decidedly harmful"

* The actual category into which the various impurities should be placed will depend upon the indigenous flora of the district where they are introduced; the majority of the ordinary weed seeds, under average conditions in England and Wales, would probably fall into the classes as here given: they should, however, be carefully checked for every characteristic area.

weeds may be troublesome if introduced to the extent of 1 to 2 per cent., and almost certainly will be if present in larger amount. A high percentage (2 to 3 per cent., or in some instances up to even 5 per cent.)* of impurity, consisting chiefly of "slightly harmful" weeds, need not afford grounds for rejection, especially if the sample has compensating advantages. Such a sample would often be preferable to one giving a purity of 99 per cent. but of which the impurity consisted chiefly of weeds of the first order.

"Decidedly harmful" and "slightly harmful" weeds are often present in very large amount, and then, as Biffen† has pointed out, they are a considerable source of trouble and expense in the preparation of high-grade samples.

Weed seeds are sometimes of value as giving an indication of the probable country of origin of at least a part of the sample containing them.

2. **Place of Origin of Sample.**—This is a question which, in the case of the grasses and clovers, has not received the attention it deserves. It has often been said, and is emphasised in some trade catalogues, that Italian Rye-grass used for catch cropping or for other "quick return" purposes should be of foreign (Southern) origin; while British-grown Cocksfoot and Perennial Rye-grass are frequently preferred for grass of long duration. The writer is at present experimenting with clovers obtained from different sources. It is already apparent that Chilian red clover, when grown at low or moderate altitudes, is "quicker" than Welsh or English stocks; it tends to be more abundant in the covering corn; it is "prouder" in the autumn after the corn is harvested; and it tends by that period also to come into flower more often and more freely than the home-grown clovers. These are serious defects in a short-lived perennial plant if it is desired to keep it on the land as long as possible.‡

* For instance, 5 per cent. of impurity, consisting chiefly of Bladder Campion, *Caucalis* spp., Trefoil and Ribgrass, but free from Wild Carrot and Dock, would not have a serious land-fouling influence if sown at high elevations on non-calcareous shales in Mid-Wales.

† *Loc. cit.*

‡ Plot trials were started at five centres last spring, to test the duration of Chilian red clover against selected English and Welsh stocks. At every centre except one (above 1,000 ft.) the Chilian clover had by October produced the largest plants, was at three centres the only clover in flower, and at another centre was more obviously in flower than the one "English" plot which had only one or two flowering plants on it. At the fifth centre (above 1,000 ft.) the Chilian clover had not taken so well as the English or Welsh; individual large plants were to be found but none were in flower. At another centre (at a low elevation) 2 lb. of Chilian clover with some Italian rye-grass was sown on one plot, and 4 lb. of Welsh clover with rye-grass on another plot. The object was to provide an autumn bite for sheep. The Chilian plot had by October more clover on it than the Welsh and was slightly in flower.

Trials conducted at Aberystwyth a few years ago showed Welsh stocks to be more lasting than French or even Canadian (the Chilian clover was not included in the trials). Further, it is a common belief that the home-grown stocks produce the most hardy and lasting clover plants; samples of these clovers are, moreover, frequently priced at 1*d.* per lb. more than undesignated stocks in the catalogues of seed firms. Many farmers also, who grow clover seed, have established home-grown stocks which have considerable local reputations. It is almost certain, therefore, that the country of origin of samples should be more generally considered when selecting grasses and clovers for different purposes. The Chilian red clover, and doubtless also Italian rye-grass, from Southern countries, may, if sown with the corn for the explicit purpose, be relied upon to give a better autumn bite for sheep than other stocks, at all events at reasonable altitudes. In the more southern counties, or on sheltered fields elsewhere at low elevations, the Chilian clover may also be expected to bulk well in the first year's hay.

At high elevations and elsewhere when fields are seeded down for leys of long duration the home-grown clovers would seem to be the most desirable, and are for this purpose probably worth decidedly more per lb. than other, or mixed, stocks.

It is, however, the exception for samples of grasses and clovers* to be sold as definitely harvested in any particular country; more often the stocks on the market are of mixed origin. The mixing of stocks is doubtless to some extent necessary, in order to obtain uniformly high standards of germination, but it is an ill-service to the farmer if seed from unsuitable countries is largely employed.

3. **Price.**—From what has been said above it will be apparent that price should not be reckoned on the basis of "real value" only: the degree of harmfulness of the weed seeds and the place of origin of the sample are often equally important.

Judged by these standards there can be little doubt that much seed, although perhaps complying with a high guarantee of germination and purity, is purchased at a very dear price by the farmer. In the majority of cases the seeds here reported upon have come up to their guarantees, and have

* Clovers are often sold as English or Welsh or occasionally as Chilian—sometimes as "mixed," but in the greater number of cases are just "Broad Red Clover," "Cowgrass," or "Late Flowering Red Clover."

been sold at fair prices on the basis of their "real values," although, as heretofore, individual samples have been met with at a flagrant overcharge. The number of samples that are suspect as to their origin or are unsatisfactory as to weed seeds will be seen to be considerable.

A few notes on some of the more important characteristics of the chief species tested are given below.

Red Clover.—No distinction has been made between red clover and cowgrass, since the seeds exhibit little or no difference, although, as Jenkin* has shown, those of cowgrass seem on the average to be a little the heavier. Repeated observations in the field suggest, moreover, that "cowgrass" is often nothing but a name.

Welsh.—These samples were studied in some detail.† Comparatively few of those received were highly cleaned and dressed, and many contained from 5 to 10 per cent. of small poorly-harvested and shrivelled seeds of but slight germinating capacity. The majority were of a rather dull appearance. One sample, although harvested in 1915, contained 36 per cent. of dull ill-formed seed, giving the sample the general appearance of an old stock. It had a germination of 50 per cent. Ten samples gave germinations of 80 per cent. and under. A few samples were received which had all the appearance of being genuinely Welsh, with germinations of 95 per cent. to 97 per cent. and containing less than 0·5 per cent. of impurity. Several samples, however, contained over 5 per cent. of impurity, over 10 per cent. being met with twice. Eleven of the 37 samples contained considerable amounts of poorly-harvested rye-grass caryopses. *Caucalis* spp. in appreciable amount were found in 9 samples; this impurity is seldom met with in highly machined samples, but is plentiful in partially cleaned home-grown stocks. Ribgrass was present to a greater or less extent in nearly every sample; wild carrot, dock and thistle were frequent.

It is interesting to note that comparatively clean samples can sometimes be obtained direct from the farmer who grew the seed; one such sample had a purity of 99·7 per cent., and contained a little ribgrass and geranium only. The impurities, however, were usually high, or when low contained objectionable weeds like dock and wild carrot. The highest

* Report on Seeds tested in 1913–15, at University College of North Wales, Bangor.

† Mr. J. L. John, B.Sc., Agricultural Organiser for Montgomery, was good enough to furnish the writer with the history of a number of samples received from and grown in that county.

germination reached by such samples was 91 per cent., the average (for 7 samples) being 74·7 per cent.; which shows the amount of dressing that is frequently necessary to bring the home-grown samples up to a high standard of germination. The American clover dodder was found in one sample definitely sold as Welsh, and three further samples contained impurities highly suggestive of at least adulteration with foreign stocks.

English.—The above remarks as to Welsh red clover would seem to be very generally applicable to the English samples also, *Caucalis* spp. and rye-grass caryopses being frequent impurities. One sample, definitely sold as English, contained the American clover dodder, and another included impurities making the place of origin of at least part of the sample very suspicious.

Not Designated.—Several of these samples were probably of British growth. Two were almost certainly wholly of South American origin, containing as they did respectively 0·9 per cent. and 0·8 per cent. of the American clover dodder. Ten contained small quantities of this dodder, and eight additional samples contained weeds indicative of the use of foreign stocks. The ordinary clover dodder was met with in small amounts in several samples. Ten samples germinated 80 per cent. and under.

Alsike Clover.—Four samples were definitely sold as Canadian and three as English. In the main these samples did not differ very much from those with no particular designation; one "English" sample, however, contained impurities which suggested mixing with foreign stock. A large amount of Alsike put on the market, however, is probably Canadian, for numerous samples contained varying amounts of the "pepper grasses," and it is interesting to note that such samples frequently also contained seeds of the creeping or "Canadian thistle," and sometimes also those of *Poa* spp., which latter are not a disadvantage. Clover dodder was only found in a few samples, the commonest impurities being self-heal and sheep's sorrel. A common defect of Alsike samples was found to be the large amount of trefoil and yellow suckling clover they often contained; and hard seed to the extent of 15 to 20 per cent. was not an uncommon occurrence. Eleven samples germinated 80 per cent. and under.

White Clover.—Five samples were definitely sold as English. These were fairly satisfactory, but two contained dock, and wild carrot, and one contained over 2 per cent. of *Geranium molle*. Dodder was found in eight of the undesignated

samples. Yellow suckling clover and trefoil were also far too abundant in samples of this expensive clover, occurring in varying amounts in 20 of the 46 samples, 20 per cent., 17 per cent., and 10 per cent. being met with. Further, 20 per cent. of hard seed was not an uncommon occurrence. Ten samples germinated 80 per cent. and under. One sample of Wild White Clover harvested in Montgomery was received. It consisted of —

Poorly-harvested seed, 62·8 per cent.		with a germination of 32 per cent., with 5 per cent. hard seed.
Good seed, 34 per cent.	.. ..	
Red clover, 3 per cent.	.. ..	
Trefoil, 0·2 per cent.	.. ..	

Trefoil.—It is only necessary to remark that the percentage of hard seed was usually low; dodder was always absent and land-fouling weeds were infrequent, field madder not usually being very serious (from this point of view). Two nice samples of "English" trefoil were received.

Yellow Suckling Clover.—This clover does not usually act as a carrier of very harmful weed seeds. Sheep's sorrel, and Yorkshire fog caryopses, however, occurred in some samples. The common defect of these samples was the high percentage of hard seed, 17 per cent. being the average for the 10 samples received, while 30 per cent. and 5 per cent. were the highest and lowest figures recorded.* A high percentage of hard seed is invariably correlated with a high percentage of very small seed.

Italian Rye-grass.—The chief defects of the samples, apart from low germinations, were (1) the frequent occurrence of soft brome and Yorkshire fog, and (2) the high average percentage of perennial rye-grass seed present, all the samples except two containing this seed to the extent of from 2 per cent. to 63 per cent.—25·7 per cent. being the average figure. Twelve samples germinated 80 per cent. and under.

Perennial Rye-grass.—The occurrence of soft brome and Yorkshire fog was too frequent, 9 per cent. of the former and 6·3 per cent. of the latter having been met with in samples. Ten samples germinated 80 per cent. and under.

One home-grown sample was received. It germinated 18 per cent., the impurities consisting chiefly of empty husks and Yorkshire fog.

* This is a very serious defect in the area from which the samples are drawn, for yellow suckling clover is an indigenous plant which comes in abundantly at about the fourth year, but sowings of good seed (with a low percentage of hard seed) have shown excellent results, even in the first year. Average seed purchased locally is not worth sowing.

Cocksfoot.—The germination averaged a low figure; eight samples were below 61 per cent. and six between that figure and 80 per cent. The impurities in cocksfoot are not usually serious; 13 per cent. of perennial rye-grass was recorded, and dock, brome, and Yorkshire fog sometimes occurred. One sample contained 2 per cent. of serradella, linseed and cornflower.

Timothy.—The majority of the samples received would appear to be of North American origin, containing as they did seeds of *Potentilla monspeliensis* et sp. and *Poa* spp. One sample contained considerable amounts of bent and some few samples traces of the creeping thistle. Only 4 samples germinated 80 per cent. and under. The most noteworthy feature was the frequent inclusion of some Alsike clover, while *two samples also contained seeds of the ordinary clover dodder.*

Crested Dogs'-tail.—Soft *Crepis* and rough sow thistle were common impurities. It would seem that a few seeds of this grass may sometimes remain "hard" in a similar manner to those of the clovers.

The Meadow Grasses.—Smooth-stalked meadow-grass usually contained seeds of the pepper grasses.

Four of the seven samples of rough-stalked meadow-grass contained seeds of *Alopecurus geniculatus*—one to the extent of 1·5 per cent. and another 2 per cent., an impurity that might be serious if the samples were sown on very wet land.

Other Grasses.—One sample of *Meadow Fescue* with a germination of 5 per cent. was designated perennial rye-grass. Samples of this grass are usually very pure; one sample, however, contained 4 per cent. of soft brome. Two samples of *Fine-leaved Fescues* contained seeds of serradella. One sample of *Tall Oat* contained seeds of *Alopecurus agrestis.*

Seed Mixtures.—These were usually (1) Alsike and White Clover, (2) "Bastard" Clover, and (3) Alsike and Timothy. They had a common characteristic, *i.e.*, that the cheapest ingredient was usually the chief constituent and of the best germination. For instance, a mixture of Timothy and Alsike consisted of 25·4 per cent. of the latter with a germination of 50 per cent., and 71·2 per cent. of the former with a germination of 99 per cent., and 3·4 per cent. weeds. Dodder occurred in three out of nine such samples. Trefoil contributed 27 per cent., and yellow suckling clover 10 per cent. to a sample of "Bastard," which consisted for the rest of white clover with a germination of below 50 per cent.

Ribgrass.—The interesting thing in connection with samples of ribgrass or plantain was not so much the germinating capacity of this very doubtful plant, but the general characteristic of the samples. It is true that some samples contained 20 per cent. or even 30 per cent. of red clover, and appreciable amounts of chicory; wild carrot and dock were common impurities, and *dodder in considerable amount was found in one sample.*

The Cereals.—Only a few samples of cereals came to hand; the results obtained in 1914, when a larger number were tested, were, however, confirmed; and the frequent low germination of "seed" corn should be emphasised. Equally important is the extent to which "seed" samples of barley are contaminated with the spore clusters of the closed smut.

Other Plants.—Attention should be drawn to the very low average germinations of the *Onion,* and *Mangold* samples. The highest germination for the latter plant was below the average of those reported upon by Biffen for 1912–14, whilst the average figure for the onion was only 3 per cent. above the lowest figure recorded by Jenkin for 1913–15.

Summary and Conclusions.—If the figures for 1915 are compared with those for 1916 the difference in the germinations for the average of all the chief species is only 2 per cent. in favour of 1915.

The 1914 figures were about the same as those recorded in 1916; all three years, however, show a substantial advance on the 1913 results.*

The number of samples of the different species received is of interest as indicating the comparatively small extent to which such useful plants as the meadow grasses, crested dogs'-tail, and chicory are employed, and the very considerable use which is still made of trefoil, although in many localities, especially on non-calcareous shales at high elevations, it is a useless plant.

Timothy and cocksfoot in particular would now seem to be employed to a moderate, although insufficient, extent.

It is not necessary to reiterate in this report the financial loss the farmer often sustains when purchasing very low grade seed; or to emphasise the obvious defects of inferior seeds.†

* This, unfortunately, does not necessarily imply that the quality of seeds used in this area has improved, since it is not usually the farmers who employ the worst grade seeds that "bother" to have them tested, and nearly all the samples tested in 1914–15–16 were submitted to the College by farmers and vendors, whilst many of the 1913 samples were obtained specially.

† See the articles in this *Journal* mentioned at p. 849, and Special Leaflet No. 24 (*Seed Testing*).

It is perhaps of greater importance to draw attention to certain precautions that should be taken in the purchase of medium or even high-grade seed—that is, seed which from casual inspection or from the terms of the guarantee under which it is sold may seem *prima facie* desirable. It is important, too, that the farmer should be able to discriminate between several samples apparently similar in quality.

In the first place more attention should be paid to the actual terms of guarantee under which the seeds are sold. It is too often thought that if seeds are offered even under partial or ridiculously low guarantees they are, therefore, beyond reproach. An examination of current catalogues will show that the guarantees as to germination are usually quite explicit and the figures high. Quotations sent out with seeds from both wholesale and retail firms are usually also satisfactory as to germination. A comparatively low germination is sometimes unavoidable, and in any event is frequently sufficiently allowed for in the price quoted. The guarantees as to purity are not usually explicit. In some few cases the seeds are "warranted pure," but are more often spoken of as "pure genuine seed"; such statements may be taken, by custom, to imply a purity of 99 per cent., and in the case of clovers are tantamount to a guarantee of absence of dodder; they do not necessarily vouch for less than ·5 per cent. of dock and wild carrot in clovers, or of soft brome and Yorkshire fog in rye-grasses. The rye-grasses are, moreover, frequently sold merely as "recleaned," with a guaranteed bushel weight, but without a definite statement as to purity. The quotations as to purity are often so low as to be almost meaningless. Clovers have been received with quotations for purity as low as 92 per cent., 94 per cent. to 96 per cent. being not at all uncommon. Clovers are, however, frequently quoted as 99 per cent. pure. The rye-grasses, cocksfoot and other grasses have been received with quotations as low as 94 per cent. Cocksfoot, crested dogs'-tail and the meadow grasses have been met with at even lower quotations for purity.

When selecting seeds from quotations the farmer should, therefore, know in which species he may expect to find "land-fouling" and "decidedly harmful" weeds, and in which species the impurities are usually of a comparatively harmless nature.

The results given in the body of this report are informing in this direction, and show that the following plants (placed in order of their danger) are to be regarded as the worst disseminators of "land-fouling" and "decidedly harmful" weeds.

In *Red Clover* dodder is frequent; dock and wild carrot and thistle were found in appreciable amount in 20 per cent., 22 per cent. and 4 per cent. respectively of the samples; whilst ribgrass and geranium may occur in amounts up to 10 per cent. for the former and 6 per cent. for the latter.

Rye-grasses almost always contain at least traces of soft brome and Yorkshire fog; 25 per cent. of the samples dealt with contained up to 2 per cent. of these impurities, whilst one sample contained 9 per cent. of soft brome and another 6·3 per cent. of Yorkshire fog.

White Clover frequently contains the ordinary clover dodder (more generally destructive than the Chilian). Dock and thistles are not uncommon, whilst sheep's sorrel may occur to the extent of over 10 per cent. and self-heal up to 5 per cent.

Alsike Clover may contain all the above weeds, but on the average not to the same extent as white clover. It contains, however, rather more thistle seeds.

Crested Dogs'-tail was of high average purity, but 50 per cent. of the samples contained soft crepis in appreciable amount, 1 per cent. of this impurity being twice met with.

Trefoil is not a serious distributor of weeds, although occasionally containing dock in appreciable amount.

Timothy, if impure, usually contains North American weeds of no significance—although it may come under suspicion as a carrier of dodder. *Cocksfoot*, *Meadow Fescue*, and the permanent grasses generally, do not usually contain weed seeds of a harmful order, although soft brome and Yorkshire fog occur in some samples.

Weed seeds are, of course, only capable of fouling the land if they have a fair germinating capacity. The more harmful seeds have been tested, and although often of a slightly lower germination than the samples containing them, soft brome, Yorkshire fog, dock and wild carrot have usually germinated from 50 per cent. to 80 per cent.

It so happens that the samples which may be regarded as the worst carriers of "land-fouling" weeds, *i.e.*, red clover and the rye-grasses, are also the ones which are most generally sown *and sown, furthermore, in large amount per acre.*

It is a common practice to sow 20 lb. of rye-grasses and 10 lb. of red clovers to the acre, with or without other plants, even for long duration grass. Let it be assumed that the seeds used were 98 per cent. pure and were such that the rye-grasses contained 1 per cent. soft brome, 0·5 per cent. Yorkshire fog, and 0·5 per cent. comparatively harmless impurity, while

the red clovers contained 0·5 per cent. divided equally between wild carrot and dock, and 1·5 per cent. of comparatively harmless impurity. Seeds of this quality would be very generally considered satisfactory, but the sowing of harmful weed seeds would, nevertheless, be approximately as follows:—

Soft Brome	30,000 seeds	per acre.
Yorkshire Fog*	89,000 ,,	
Carrot*	11,000 ,,	
Dock*	8,000 ,,	
Total	138,000 ,,	

It may be safely conceded that half of these seeds would germinate; and that half of those that germinated would compete successfully with the grasses and clovers. On this conservative estimate the farmer who employed the seeds in question would have established seven "land-fouling" weeds on every square yard of his field.

The accumulative effect of the damage done by Yorkshire fog, particularly under meadow conditions and especially on poor soils, has already been demonstrated by the writer.†

Wild carrot also spreads rapidly on a field both under pasture and meadow conditions, for it flowers and ripens its seed late, which it is able to do on the aftermath in meadows.‡ Both immediate and subsequent damage are most apparent on poor land, for the "take" is frequently unsatisfactory, and, even if it is good, the turf does not knit together quickly. This affords a conclusive argument in favour of using clean (usually, but not necessarily, expensive) seed on poor land. Particular *care should consequently be taken in the purchase of samples* to be sown in bulk, especially on poor land. Impurity to the extent of 1 per cent. in rye-grasses (sown at the rate of 1 bush. to the acre) may mean the introduction of twenty times as many

* The calculation for these species is based on the figures given in an article in this *Journal*, Vol. xxi, March, 1915, *Seed Testing for Farmers*.

† See *e.g.* the 1913 Seed Report (p. 33) quoted in the footnote on p. 832 of this article.

‡ Long (*Common Weeds of the Farm and Garden*) quotes Morton as giving 1,200 seeds of wild carrot to each plant. If only one plant established itself from the original sowing on 10 yards square, and if only one-hundredth (to make a liberal allowance for ripening and establishment on the turf) of its progeny grew up as plants we should have, say one wild carrot plant on every square yard of the field by the spring of the second year (= third year from time of sowing under the covering crop). These would be strong and unmistakable in the third year's herbage, and would that autumn give rise to a further crop of seed; the degree of subsequent spoliation would, however, chiefly depend upon the condition of the turf.

Such results accord well with observation in the field, infinitely worse spoliation having been frequently met with. Long also quotes H. Dorph-Petersen as giving 4,000—110,000 carrot seeds per plant, but Morton's estimate is taken since wild carrot frequently does not produce many flower heads when growing on grass land.

land-fouling weeds as, say, 2 per cent. of impurity in Timothy (sown at the rate of 2 lb. to the acre). In like manner 1 per cent. of weed seeds in red clover is frequently more serious in its effect on the land than 2 per cent. or even 3 per cent. of impurity in white clover.

Seeds of "land-fouling" weeds will be sown just as long as farmers are content to purchase seeds on unsatisfactory guarantees and quotations, or at sight. If the demand were sufficiently emphatic the rye-grasses and red clover could be put on the market guaranteed 99 per cent. pure, *free* from dodder, wild carrot, dock, and thistles, in the case of clovers, and from Yorkshire fog and soft brome in the case of rye-grasses.*

Much seed at present obtainable would no doubt comply with this drastic guarantee. Numerous samples of rye-grasses, in particular, however, have passed through the writer's hands, which although sold under high-sounding guarantees are none the less quite unsatisfactory with respect to Yorkshire fog and soft brome.

The second point to be emphasised is the condition of the average home-grown red clovers and their importance to the farmer. It has already been pointed out that Welsh stocks are very generally considered the best for laying down land to long duration grass, at high elevations. Plot evidence so far collected tends to confirm this, and also suggests that Chilian stocks, at least, are not at all well adapted to this purpose.

The Montgomery clovers in particular, and the British ones generally, are seldom harvested under ideal conditions. They are consequently often rather dull in appearance, contain a high percentage of ill-formed seeds, and can generally only be guaranteed to give a germination of 97 per cent. to 98 per cent. and a purity of over 98 per cent. when especially well dressed and machined; *or if adulterated with a bold sample of, say, Chilian red clover, which will have the further effect of brightening the sample.*†

A very large proportion of these seeds is put on the local market after but little re-cleaning, many being put on the market or sold from farmer to farmer just as they come from the

* "Free from" should by custom be taken to mean absolutely no dodder, and not more than the merest traces (say, ·2 per cent.) of dock, thistle, carrot, and Yorkshire fog.

† A farmer this season had purchased "Welsh Clover" from a large (non-local) firm under a high guarantee of germination and purity. The ordinary small sample brought into the College by the purchaser aroused suspicion. Three pounds were brought in the next week, when Chilian dodder was unmistakably found to be present in the minutest traces. The firm admitted that adulteration with the implication, however, that they had greatly improved the sample in doing so.

thrashing and winnowing machines. Consequently a large proportion of home-grown samples is decidedly impure, containing in particular far too much dock and wild carrot, are unprepossessing in appearance, and have relatively low germinations.

Farmers (and there are many) who attach especial value to home-grown clovers should therefore regard bright bold samples with some suspicion, and would be well advised not to assign too much importance to a high guarantee of germination; and in the selection of samples should be particularly careful to choose one free from docks and wild carrot, and from the American clover dodder or other weeds which suggest adulteration with clovers of foreign origin.

It is these samples, perhaps more than any others, that should be sent to the Agricultural Organiser in the farmers area, or direct to the Adviser in Agricultural Botany for the Province, for a report before a purchase is made. The proper estimation of their probable value depends not so much on a pleasing appearance or high figures of purity and germination as on a just appreciation of the sample as a whole.

For instance, in 1915, the writer selected a "Cotswold Red Clover" at low price for a co-operative society.* It had a germination of but little over 80 per cent., contained a good deal of dirt, some ribgrass, and other comparatively harmless weeds, but was free from seeds of "land-fouling" weeds. It was chiefly used mixed with a higher grade sample of "English Clover." One farmer in particular, however, used it as the only red clover, harvested a satisfactory crop of clover hay this summer, and obtained a particularly good aftermath. The above is perhaps an extreme case, but the writer has constantly advised local farmers to use selected Montgomery, and other home-grown clover, often with germinations not exceeding 90 per cent., with demonstrably good results.

It must not be thought that the writer advocates the purchase of medium grade seed as such. Seed of this quality should always be purchased on the advice of an expert botanist only, and, unless harvests have been exceptionally bad, a minimum germination of about 85 per cent. should be regarded as

* Co-operative societies, even those that are doing excellent pioneer work as to seeds, have frequently, in self-defence, to stock a cheap red clover as "second choice." It is a fact, furthermore, that even farmers who are prepared to pay a fair price for their mixtures are prone to insist on the inclusion of some "No. 2" red clover. The proper selection of these cheaper clovers is consequently of the greatest importance.

essential. The frequent success of medium grade seed, however, in which is included so much of our home-grown stocks, cannot be ignored. Medium, equally with high grade, seed is only permissible if it is sold at a fair price, and if it is absolutely pure in respect of "land-fouling" weeds. Purity in medium grade seed is, more often than not, due to the clean conditions under which the particular sample was grown, while the complete absence of "land-fouling" weeds in higher grade samples is frequently due to the same cause.

Looked at from a national, or, better, from a world-wide point of view, it would seem to the writer more economical to make certain of pure seed by growing clean seed, than to depend almost solely upon subsequent intricate cleaning processes. It must also be remembered that only a portion of our home-grown clovers passes through adequate cleaning machinery, and this is probably equally true of the world's seed supplies as a whole. Again, the fact that excellent red-clover "plants" can be obtained from quite undressed samples with germinations of even under 85 per cent. shows that *excessive* machining is not really necessary with a view to selecting "plant-producing" seeds of this species.

The elaborate cleaning operations that are usually desirable, and frequently practised, under existing conditions, must of necessity involve either considerable waste or grading.

Samples at the highest prices should be "selected" rather than "graded" stocks.* A certain limited amount of grading may possibly be desirable, but excessive grading is at best an unfair and probably also the least economical way of using the world's (or a country's) seed supplies, for what is then one farmer's gain is another's loss.

Highly clean seed can be grown, and is grown, its attainment only demanding close attention to obvious details and adequate supervision.

NOTE.—The following articles and notes on "Seed Testing" recently appeared in this *Journal* :—

1. Vol. XXIII., No. 2, May, 1916, p. 160, *Seed Testing in North Wales.*
2. Vol. XXII., No. 11, February, 1916, p. 1041, *Report on an Inquiry into the Quality of Farm Seeds, 1912-14 :* R. H. Biffen, M.A., F.R.S.
3. Vol. XXII., No. 11, February, 1916, p. 1055, *Seed Testing and the Need for Destroying Weeds.*

* "Selected" stocks of grasses and clovers are, of course, put on the market to a certain extent, but the mixed assemblage of weed seeds, and the tendency of samples to contain seeds of a fairly similar size, show that "selection" and "grading" are frequently synonymous.

4. Vol. XXII., No. 12, March, 1916, p. 1290, *Seed Testing at Aberystwyth.*

5. Vol. XXI., No. 12, March, 1915, p. 1098, *Seed Testing for Farmers.*

(In addition to giving a number of informing tables, this article contains a list of Agricultural Colleges to which farmers should apply for advice as to examination of seeds, and references to seven other articles appearing in this *Journal*).

PALM KERNEL CAKE AND MEAL AS FOOD FOR PIGS.

REPORT ON AN EXPERIMENT CONDUCTED AT WITHGILL PIGGERIES, NEAR CLITHEROE.

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INTRODUCTION.

IN the Report of the Colonial Office Committee on Edible and Oil-producing Nuts and Seeds, issued in June of the present year, the opinion is expressed that further experimental work with palm kernel cake and meal is desirable, with a view to obtaining more precise information as to their merits as foods for farm stock.

With a view to developing such work the directors of the Co-operative Wholesale Society, Ltd., at the request of the Colonial Office, kindly undertook to grant facilities for an experiment to be carried out at their extensive piggeries at Withgill, near Clitheroe.

The preliminary arrangements were made early in the year and, at the request of the Directors and of the Board of Agriculture and Fisheries, the general supervision of the experiment was undertaken by the writer.

The selection of the pigs for the purpose was made on 5th April with the assistance of Mr. W. R. Crawford, Live Stock Officer for Yorkshire, and the experiment continued until 20th September, a period of 24 weeks, of which the last 20 weeks may be regarded as the experiment proper.

Two forms of palm kernel residue are on the market: (1) cake from mills in which the oil is removed from the ground kernels by pressure, and (2) "extracted meal" from mills where the oil is removed from the ground kernels by the use of benzine or other volatile solvents. The essential difference between the two residues is that the extracted meal is commonly much poorer than the cake in oil, and correspondingly richer

in albuminoids, carbohydrates and fibre. The usual variations in the percentages of these chief constituents are:—

	Cake.		*Extracted Meal.*
	Per cent.		*Per cent.*
Oil	6—10	..	1—3
Albuminoids	17—19	..	18—20
Carbohydrates	42—48	..	46—52
Crude fibre	11—15	..	14—20

It was decided to test the merits of both cake and meal in comparison with a feeding-stuff of approximately similar composition that is widely used in pig-feeding. For this purpose the material selected was the grade of milling offal known locally as "thirds" or "fine sharps." This feeding-stuff was supplied direct to the piggeries from the mills of the Co-operative Wholesale Society, Ltd. The palm kernel cake and extracted palm kernel meal were obtained from the African Oil Mills Company, Ltd., Liverpool.

Samples of the three feeding-stuffs as used for the experiment showed the following composition:—

	Thirds.	Palm Kernel Cake.	Extracted Palm Kernel Meal.
	Per cent.	Per cent.	Per cent.
Moisture	12·40	10·27	9·99
Albuminoids	16·83	17·12	17·26
Oil	4·44	7·07	1·25
Soluble carbohydrates ..	58·01	47·79	51·59
Crude fibre	4·96	14·09	15·97
Mineral matters	3·36	3·66	3·94
	100·00	100·00	100·00

Assuming equal digestibility for the three foods, and using the conventional method of the agricultural chemist for assessing the relative values of feeding-stuffs from chemical analysis, it might be expected that the thirds would prove slightly superior to the palm kernel cake meal and a good deal better than the extracted palm kernel meal.

PLAN OF EXPERIMENT.

On 5th April 54 pigs (31 hogs, 23 gilts) of approximately uniform character were selected for the purposes of the experiment and divided into nine pens of six animals each. In selecting the animals for the different pens the greatest care was taken to secure that the pens should be as uniform as possible with regard to breed, weight, age, and distribution of sex. The pigs were about 16 weeks old, and were mostly of the

Large White breed. After selection, each pen was weighed separately, and further weighings took place regularly at intervals of four weeks throughout the experiment. With the weighbridge available the weights could be determined to the nearest half-stone, representing an accuracy of about three per cent. of the total weight per pen at the outset and a relatively greater accuracy as the pigs increased in weight.

For the first month (4 weeks) all the pens were fed exactly alike, with a view to testing the degree of uniformity in feeding capacity attained in the selection of the pens. During this period, however, from each of two pens two pigs were lost through accidents, so that the rate of gain of these pens could not be ascertained. For the remaining seven pens the live-weight gains for the month ranged from 8 to 10½ stones per pen, or an average of 4·7 to 6·1 lb. per pig per week.

For practical reasons it was not thought desirable to introduce fresh pigs into the two depleted pens and, consequently, these pens were withdrawn entirely. Moreover, since for the purposes of the experiment it was intended to group the pens into three lots of three pens each, it was decided to withdraw also a third pen of the original selection and introduce three freshly-selected pens. Accordingly, on 3rd May, a further selection of 18 pigs was made, and these divided into three pens, the selection and allocation being made with the same care as before. These pigs were a few weeks younger and consequently smaller than the pigs of the remaining six pens, and in the grouping of the pens into three lots one of these lighter pens was included in each lot. In grouping the six pens, for which a month's record had been obtained, the gains in live-weight for the month were taken into account in order to secure as far as possible the desired uniformity in feeding capacity.

For convenience of description the lots and pens are referred to in this Report as follows:—

Lot A:—(pens 1, 2, 3.)
Lot B:—(pens 4, 5, 6.)
Lot C:—(pens 7, 8, 9.)

Within each lot the three pens were fed exactly alike.

The pigs were housed in nine consecutive sties in the same range, each sty providing amply for shelter and exercise. The general arrangements were indeed admirably adapted for experimental purposes.

In view of the exceptional circumstances of the time it was felt that the experiment should be so designed as to disturb

the general routine of the piggeries as little as possible, and in particular to reduce to a minimum any further demands upon the available labour. Accordingly, the feeding in general use in the piggeries for the same class of pig was adopted as the basis for the feeding of the experimental pigs. The nature of this "basal ration" is set out in the schedule at the foot of this page. The practical procedure adopted was to allot an equal quantity of this basal ration to each pen and then to add for the pens of one lot a certain weight of thirds, for the pens of a second lot the *same* weight of palm kernel cake (ground to fine meal), and for the pens of the third lot the *same* weight of the extracted palm kernel meal. The experiment became thus a test of the efficiency of *equal weights* of the three feeding-stuffs when used to supplement the basal allowance.

Reference has been made to the preliminary efforts to secure uniformity in the feeding capacity of the lots, but in order to secure a further check upon inequalities in this respect the feeding was so arranged, month by month, that each lot received each of the three feeding-stuffs in turn. This arrangement will be rendered clear by the following schedule, which shows the actual order of feeding adopted :—

Average Rations per Lot (18 Pigs) per Day for each Month.

—	Basal Ration.	Additional Food.		
		Lot A.	Lot B.	Lot C.
PRELIMINARY MONTH. (April 5—May 3).	33⅓ lb. Coarse sharps. 33⅓ ,, Fine sharps (Thirds). 8 ,, Barley meal. 8 ,, Fish meal.	—	—	—
FIRST EXPERIMENTAL MONTH. (May 4—31).	Coarse sharps, Barley meal, Fish meal } as before. 16⅔ lb. Thirds.	16⅔ lb. Palm kernel cake.	16⅔ lb. Extracted palm kernel meal.	16⅔ lb. Thirds.
SECOND EXPERIMENTAL MONTH. (June 1—28).	33⅓ lb. Coarse sharps. 9⅓ ,, Barley meal. 9⅓ ,, Fish meal. 6⅔ ,, Bakery refuse.	24 lb. Palm kernel cake.	24 lb. Extracted palm kernel meal.	24 lb. Thirds.
THIRD EXPERIMENTAL MONTH. (June 29—July 26).	As in preceding month	24 lb. Extracted palm kernel meal.	24 lb. Palm kernel cake.	24 lb. Thirds.
FOURTH EXPERIMENTAL MONTH. (July 27—Aug. 23).	16⅔ lb. Coarse sharps. 16⅔ ,, Special pig meal 10 ,, Barley meal. 10 ,, Fish meal. 6⅔ ,, Bakery refuse.	24 lb. Extracted palm kernel meal	24 lb. Thirds	24 lb. Palm kernel cake.
FIFTH EXPERIMENTAL MONTH. (Aug. 24—Sept. 20).	16⅔ lb. Coarse sharps. 8⅓ ,, Thirds. 8⅓ ,, Pig meal. 10 ,, Barley meal. 10 ,, Fish meal. 6⅔ ,, Bakery refuse.	24 lb. Thirds	24 lb. Palm kernel cake.	24 lb. Extracted palm kernel meal.

The proportion of palm kernel cake (or meal) formed at first roughly one-fifth of the total food supply and was gradually increased to about two-sevenths, but when increased temporarily beyond this proportion symptoms of scouring set in, and it was deemed inadvisable to raise the proportion further.

It was originally intended to conduct the experiment for six months, so that each lot might receive for two months each of the three feeding-stuffs under comparison. This was rendered impossible and, indeed, the success of the experiment jeopardised at the very outset by an outbreak of swine fever in the piggeries during May. No case of fever occurred either then or subsequently amongst the experimental pigs, but it was necessary for them to receive serum injections on 18th May and again (after weighing) on 31st May. The steady progress of the pigs was thus seriously interfered with during the first experimental month, and it became necessary to prolong the same feeding over the second month. Three pigs (one each from Pens 2, 3 and 5) were lost by death in the course of the experiment, but in only one case did post-mortem examination reveal any sign of digestive disturbance, the other two deaths being clearly due to lung troubles. It was also necessary during June to remove one pig from Pen 8 owing to its very unsatisfactory progress.

The practical conduct of the experiment was in the hands of the foreman, under the supervision of the manager, Mr. Robinson, and to the great care, patience and skill exercised by them, under difficult conditions, the ultimate success of the experiment is due. Beyond the unavoidable troubles indicated, no hitch occurred at any stage of the experiment.

RESULT OF EXPERIMENT.

(a) Rate of Increase in Live-weight.

The average weights per pig at each monthly weighing from 3rd May, when the experiment proper began, are shown in the following table:—

Average Weight per Pig, in pounds.

Date of Weighing.	Lot A.			Lot B.			Lot C.		
	Pen 1.	Pen 2.	Pen 3.	Pen 4.	Pen 5.	Pen 6.	Pen 7.	Pen 8.	Pen 9.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
May 3	130·7	114·3	101·5	133·0	98·0	127·2	131·8	123·7	98·0
May 31	165·7	150·5	134·2	161·0	124·8	161·0	161·0	152·8	136·5
June 28	197·2	185·5	155·2	193·7	155·2	192·5	185·5	204·4*	170·3
July 26	232·2	220·5	193·7	232·2	203·0*	231·0	233·3	252·0*	218·2
August 23	273·0	271·6*	239·4*	277·7	243·6*	287·0	268·3	309·4*	270·7
September 20.. ..	317·3	308·0*	277·2*	317·3	285·6*	320·8	301·0	351·4*	306·8

* 5 pigs only in pen.

The average weights per pig in each *lot*, deduced from the above data, are as follows :—

Date of Weighing.	Lot A.	Lot B.	Lot C.
	lb.	lb.	lb.
May 3	115·5	119·4	117·8
May 31	150·1	148·9	150·1
June 28	179·3	180·5	186·7†
July 26	215·5	222·1†	234·5†
August 23	261·3*	269·4†	282·8†
September 20	300·8*	307·9†	319·7†

* 16 pigs in lot. † 17 pigs in lot.

From these tables it will be seen that although the individual *pens* showed appreciable differences in initial weight, the *lots* were fairly comparable. Thus, Pens 1, 4 and 7 may be regarded as comparable, also Pens 2, 6 and 8 and finally Pens 3, 5 and 9, these last-named being the three fresh pens of younger pigs selected on 3rd May. Turning now to the increases in live-weight recorded, month by month, these work out as follows :—

Increase in Live-weight (in lb.) per Pig per Month (4 weeks).

LOT A.

—	Pen 1.	Pen 2.	Pen 3.	Average.	Special Food.
	lb.	lb.	lb.	lb.	
1st Month (May 3—31) ..	35·0	36·2	32·7	34·6	Palm kernel cake.
2nd „ (June 1—28) ..	31·5	35·0	21·0	29·2	„ „
3rd „ (June 29—July 26) ..	35·0	35·0	38·5	36·2	Palm kernel meal.
4th „ (July 27—Aug. 23) ..	40·8	51·1	45·7	45·8	„ „
5th „ (Aug. 24—Sept. 20) ..	44·3	36·4	37·8	39·5	Thirds.
Total for 5 months ..	186·6	193·7	175·7	185·3	

LOT B.

—	Pen 4.	Pen 5.	Pen 6.	Average.	Special Food.
1st Month	28·0	26·8	33·8	29·5	Palm kernel meal.
2nd „	32·7	30·4	31·5	31·5	„ „
3rd „	38·5	47·8	38·5	41·6	Palm kernel cake.
4th „	45·5	40·6	56·0	47·4	Thirds.
5th „	39·6	42·0	33·8	38·5	Palm kernel cake.
Total for 5 months ..	184·3	187·6	193·6	188·5	

LOT C.

—	Pen 7.	Pen 8.	Pen 9.	Average.	Special Food.
1st Month	29·2	29·1	38·5	32·3	Thirds.
2nd "	24·5	51·6	33·8	36·6	"
3rd "	47·8	47·6	47·9	47·8	"
4th "	35·0	57·4	52·5	48·3	Palm kernel cake.
5th "	32·7	42·0	36·1	36·9	Palm kernel meal.
Total for 5 months ..	169·2	227·7	208·8	201·9	

If now we take the average monthly increases per lot and re-group them according to the feeding we arrive at the following result :—

Increase in Live-weight (in lb.) per Pig per Month (4 weeks).

—	Palm Kernel Cake Lot.	Palm Kernel Meal Lot.	Thirds Lot.
	lb.	lb.	lb.
1st Month	34·6	29·5	32·3
2nd "	29·2	31·5	36·6
3rd "	41·6	36·2	47·8
4th "	48·3	45·9	47·4
5th "	38·5	36·9	39·5
Total (5 months) ..	192·2	180·0	203·6
Average per month ..	38·44	36·00	40·72
" " week ..	9·61	9·00	10·18

On the average of the whole experiment, therefore, the pigs receiving thirds gained *11.4* lb. per pig more than those receiving the same weight of palm kernel cake, and *23.6* lb. per pig more than those receiving an equal weight of extracted palm kernel meal. This general result is substantially borne out by the records of the individual months taken separately, the thirds coming out best in three of the five months and a good second best to the cake in the other two, whilst the meal comes out worst in every month except the second, in which it surpassed the cake.

If, however, the records of the individual pens, as given in the tables above (Lots A, B, and C), be carefully scrutinised it will be seen that in several cases there is considerable irregularity within the lots. Thus, in the second month, although the three pens of Lot B show very uniform increases, this is not the case in either Lot A or Lot C. Thus, in the former, Pen 3 shows an abnormally low increase. This is one of the pens of younger pigs, but the low increase cannot be attributed to this, since

the corresponding pens (5 and 9) show much higher increases. In the case of Lot C in this month, Pen 7 shows a rather low increase and Pen 8 a remarkably high increase. The latter finds a probable explanation in the fact that during this month one pig, presumably the worst, had to be removed from this pen owing to general unthriftiness, and the average weight per pig was doubtless appreciably raised thereby. A similar explanation would account also for the relatively high gains shown by Pen 5 in the third month, and by Pen 2 (and possibly Pen 3) in the fourth month. Other irregularities, for which the diary of the experiment affords no clear explanation, are the high gain in the fourth month and the low gain in the fifth month in the case of Pen 6, and the low gains in both these months in the case of Pen 7.

In view of these irregularities, which form a typical illustration of the difficulties with which the attainment of a high degree of accuracy in feeding experiments is beset, it would obviously be unwarrantable to assert that the above-recorded differences of 11·4 lb. and 23·6 lb. represent exact measures of the superiority of the thirds over the palm kernel cake and palm kernel meal respectively. It would, indeed, be safer to attach little weight to the precise figures and to rest content with the general conclusion that the thirds have proved slightly superior to the palm kernel cake and appreciably superior to the extracted palm kernel meal.

This conclusion coincides with expectations based upon the chemical composition of the three feeding-stuffs as indicated earlier (page 851.)

(b) Cost of Feeding.

From the practical standpoint the increase in live-weight produced is only a partial measure of the merits of the feeding-stuffs compared. Their use in practice must be governed by the relative economy of the results obtained.

The actual costs of the various foods used in the experiment were as follows:—

	Per Pack (240 lb.)	= *Per ton.*
Coarse sharps	16*s.* to 19*s.* ..	£7 9*s.* 4*d.* to £8 17*s.* 4*d.*
Fine sharps (thirds) ..	22*s.* 9*d.* to 26*s.* 6*d.* ..	£10 12*s.* 4*d.* to £12 7*s.* 4*d.*
Barley meal	28*s.* 6*d.* ..	£13 6*s.*
Fish meal	.. .. ..	£12 15*s.*
Pig meal	.. .. ..	£10 10*s*
Bakery refuse (estimated)	.. .. ..	£4
Palm kernel cake meal ..	.. .. ..	£8
Extracted palm kernel meal	.. .. ..	£7 15*s.*

From these data and the data for food consumption summarised in the schedule on page 853, the cost of total food consumed by each lot in each month of the experiment has been calculated, with the following results, expressed in terms of cost per pig per month :—

Total Cost of Food per Pig per Month (4 *weeks*).

—	Palm Kernel Cake Lot.	Palm Kernel Meal Lot.	Thirds Lot.
	s. *d.*	*s.* *d.*	s. d.
1st Month	10 10 (Lot 1)	10 9 (Lot 2)	11 5 (Lot 3)
2nd „	9 10 „	9 9 „	10 9 „
3rd „	9 10 („ 2)	9 9 („ 1)	10 10 „
4th „	10 11 („ 3)	10 10 „	12 1 („ 2)
5th „	11 4 („ 2)	11 3 („ 3)	12 10 („ 1)
Monthly average for whole period ..	10 7	10 6	11 7

On comparing now these figures with the average gains in live-weight per pig per month, as given in the table on page 856, it is seen that as compared with the pigs receiving thirds the pigs on the palm kernel cake ration cost 1*s.* per head per month less to keep, but gave 1·28 lb. less live-weight increase, whilst the pigs on the palm kernel meal ration cost 1*s.* 1*d.* per head per month less to feed, but gave 4·72 lb. less live-weight increase.

In other words, as compared with palm kernel cake the thirds gave an extra 1·28 lb. live-weight at a cost for food of 9·4*d.* per lb. live-weight, and as compared with the extracted palm kernel meal an extra 4·72 lb. live-weight at a cost for food of 2¾*d.* per lb. live-weight. The average costs of food per 1 lb. increase of live-weight for the whole period of the experiment were :—

		d.
For the	Palm kernel cake lot	3·30
„	Palm kernel meal lot	3·50
„	Thirds lot	3·41

It would appear, therefore, that the extra live-weight obtained by using thirds was dearly purchased in comparison with palm kernel cake, but cheaply in comparison with palm kernel meal. Expressed differently, it may be said that as compared with the price paid for the thirds (average £11 5*s.* 2*d.* per ton) the palm kernel cake was worth rather more than the price paid for it (£8 per ton), and the palm kernel meal at £7 15*s.* was appreciably too dear.

In submitting these estimates of comparative values a

warning must again be given against applying the results too rigidly as an actual *measure* of the relative merits of the food-stuffs compared. Attention has been directed to certain apparent irregularities in the records at some stages of the experiment which must introduce an element of uncertainty, though perhaps not very great, into even the averages for the whole period. Were the experiment to be repeated upon the same scale it is possible that the actual numerical results might differ appreciably from those here recorded, but it is more than likely that the general conclusion as to the *order* of merit of the three feeding-stuffs would be confirmed.

INFLUENCE UPON QUALITY OF CARCASS.

The general arrangement of the experiment did not lend itself to a strict comparison of the relative effects of the palm kernel foods and thirds, respectively, upon the quality of the carcasses since all three foods were consumed at one time or another by each lot. Only in the case of Lots B and C were palm kernel foods consumed during the last month of the experiment (see page 853). It is worthy of note, however, that the butcher's opinion on the pigs was quite favourable, no detrimental feature being noted in any case. It is reported that "the pigs killed well, giving carcasses of good colour, full of lean flesh and plenty of bone, but a little deficient in leaf fat." The general flavour of the pork was excellent. The oil of the palm kernel foods had thus obviously produced no detrimental effect upon the general quality of the meat.

GENERAL CONCLUSIONS.

The experiment has demonstrated that palm kernel cake and extracted palm kernel meal can be safely used as foods for pigs in proportions ranging up to almost one third of the total food supply.

With the consumption of equal weights, palm kernel cake has produced a rate of gain of live-weight almost but not quite equal to that obtained with thirds, but the extracted palm kernel meal has proved appreciably inferior in this respect.

At the prices paid for the foods the palm kernel cake has proved relatively somewhat cheaper than the thirds, but the extracted palm kernel meal has not justified its price.

The appearance, flavour and general quality of the meat obtained by the use of the palm kernel foods have proved in every way satisfactory.

A SIMPLE DEVICE FOR PROTECTING EARLY AND LATE CROPS.

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THE forcing of salads and other vegetables has been much in vogue during recent years, and there are many well-known methods of protecting such crops during inclement weather. The writer has been experimenting in Hampshire and Northamptonshire for nearly ten years with various devices, and the result of this experience is summarised below.

During the past five years the work has been done on the Northamptonshire Education Committee's Demonstration Plot at Dallington, Northampton. This plot has an area of about 60 sq. rods, and the soil is very shallow and of a sandy nature.

In this district the demand for very early or out-of-season market-garden produce is not very great, and this is particularly true with respect to all the salad crops. The majority of people only ask for salads when the weather is bright and warm, and there is only a very small and uncertain demand for salads during the winter months. For this reason the market-gardeners in the county have not generally adopted the so-called French system of intensive culture.

There is, however, a big demand for such produce just before the out-door crops are ready for sale, and a brisk trade at high prices may be done about a fortnight or three weeks before the usual time.

In the year 1906, Dr. Parsons, of Burlesdon, Hants, devised an apparatus for the protection of strawberries grown in the open ground. Several strawberry growers gave this apparatus a trial, and it produced the desired result, for the strawberries were sent to market three weeks before the unprotected fruit, but it proved to be rather too complicated. In June, 1909, at the Royal Counties Agricultural Societies' Show, the writer exhibited a device which was simpler, easier to handle, and more suitable for covering salads and early vegetables.

The Apparatus Described.—The illustrations show at a glance what the device is like, and how it is fixed over the crops. Sheets of glass are placed on each side of a row of plants and held in position by means of a simple clip. In June, 1913, when the photograph, Fig. 1, was taken, a clip made of wood and zinc was being used, but since that time a support made entirely of wood has been designed.

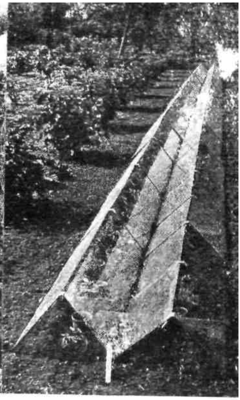


FIG. 1. FIG. 2.

FIG. 1.—The row of plants in the centre was protected for about four we (mid-April to mid-May), and the row on each side was left unprotected. crop consisted of Cauliflower, 18 in. apart, with Dwarf Kidney Beans betw and Radishes earlier in the season.

FIG. 2.—Two lines of the apparatus over Tomatoes. The glass was remo from the Cauliflowers, etc., to cover these plants in the middle of May.

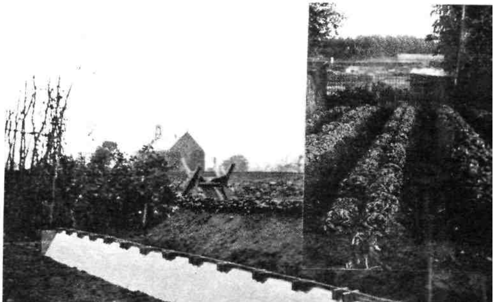
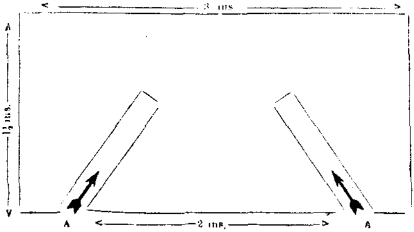


FIG. 3.—The apparatus in an open allotment field. Discarded photograph plates, 10 in. by 12 in., with the film removed, are employed in this case. No the method of anchoring thin glass of this kind to prevent damage by win The photograph was taken on 5th December, 1915, after a terrific gale whic

The following diagram shows how this support is made. Elm is to be preferred for this purpose, but many other kinds of wood can be used. The wood is first cut into blocks 3 in. by $1\frac{1}{2}$ in. and about 1 in. in thickness. Two slots are made at AA, slightly wider than the thickness of the glass which is to be supported.



The glass used is known as 4ths quality, 21-oz. horticultural glass, and this may be procured, cut to the size required, in crates containing 200 sq. ft. After many trials sheets 12 in. by 18 in. have proved the most satisfactory, as they are easy to handle and are usually quite large enough for the crops dealt with in this article. The wooden support (see diagram) is designed for this size, and at this angle the glass covers a strip of ground about 15 in. wide. Note that a space 1 in. wide is left between the glass at the top for the purpose of ventilation. This keeps the crops quite healthy, and when the glass is removed there is no check to the growth, as the plants are not forced or tender but perfectly hardy and able to stand the change.

A sheet of glass is used to close the end of each row of the apparatus. The lower side of this sheet should be pressed well into the soil, and the top may be held by a strip of zinc attached to the end wooden support and bent over to keep the glass in place.

The 21-oz. glass of the dimensions given will stand quite firmly during windy weather, even in exposed positions, but if thinner glass is used a wire should be run along the top of the apparatus through a staple in each wooden support and the ends of the wire made fast to an anchorage (see Fig. 3). Discarded photographic plates can be obtained from most photographers at a cheap rate, and when the film is removed the glass is quite suitable for the purpose, but it must be held down with

wire as explained above. The largest plate commonly used is 10 in. by 12 in., and the dimensions of the wooden supports must be varied to suit these plates. The heavier glass is, however, cheaper in the end.

Glass of all kinds is much dearer since the War began, as most of the glass used for horticultural purposes was formerly made in Belgium, but, on the other hand, in ordinary times market-garden produce is imported in large quantities from Belgium, France and Holland, and the interruption in the supply has led to an increased demand for similar foodstuffs grown in this country. Crops protected in the manner described herein should, therefore, be more valuable during the period of the War.*

Preparing the Land.—The land should be trenched at least two spits (20 in.) deep, if possible in autumn, and a liberal dressing of farm-yard manure should be thoroughly incorporated with the soil at that time. This manure must be properly mixed with the soil and must not be placed in layers.

If the land selected has been in cultivation for some years, a good dressing of basic slag should be spread evenly over the surface at least one month before sowing or planting. If the land is comparatively new, an additional dressing of powdered crude napthalene and pink carbolic powder in equal parts is to be recommended, and this mixture should be forked into the soil at the rate of 8 lb. per sq. rod (4 oz. per sq. yd.) at least three weeks before sowing or planting.

A dressing of sulphate of ammonia at the rate of ½ oz. per sq. yd. should be given about a fortnight before sowing or planting. Soot may be used instead of this manure, and, in that case, the dressing should be equal to 8 oz. per sq. yd. Wood ashes may be mixed with the sulphate of ammonia to ensure an even application. When the soil is deficient in potash the wood ashes would be very beneficial.

The ground selected should be as level as possible, and the rows of plants must run north and south. Sheets of glass 12 in. in width will cover a strip of ground about 15 in. wide, and narrow paths should be left between each strip. In the case of tomatoes, two or three rows may be placed together, as shown in Fig. 2.

Suitable Crops.—The apparatus may be used consecutively over six series of crops throughout the year, but new positions will be necessary in most cases.

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* Similar and varied appliances are used in many of the early market-gardening districts and certain growers have a partiality for certain types.

Series 1.—Glass in use during January and February.

(*a*) Dwarf peas, (*b*) Early broad beans, (*c*) Sweet peas for seed or for exhibition purposes.

The seed should be sown early in January on land prepared as described above. The drills should be made 6 in. wide and 4 in. deep. After the seed is sown in the drill in the usual manner, it should be covered to a depth of about 2 in. with a mixture of fine soil and wood ashes. The glass should then be fixed in position and will remain until it is required for the next crop.

On heavy soils it would be better to germinate the seed in a frame or green-house and plant out under the glass about the end of January. In some localities autumn sowings of these crops can be made and the plants protected with the apparatus during severe weather.

Series 2.—Glass in use mid-March to mid-April.

(*a*) Lettuces and radishes. The lettuce seed should be sown thinly in drills, two drills under each line of glass, and each drill should be about 3 in. from the centre of the 15-in. strip of ground to be covered. The seedlings must be thinned out later on. Suitable varieties are Sutton's "Nonsuch" Cos, Sutton's "Mammoth White" Cos, and Early French frame cabbage lettuce. A quick-growing short-topped variety of radish should be sown thinly broad-cast all over the strip of ground to be protected.

(*b*) Turnips and radishes. Early Milan turnip seed should be sown in drills and "French Breakfast" or other radish broad-cast, as advised above.

(*c*) Carrots and radishes. "Early Gem" or "Inimitable" forcing carrots in drills and radishes broad-cast as for (*a*) and (*b*).

Series 3.—Glass in use from mid-April to mid-May.

(*a*) Cauliflowers, lettuces, and radishes. Seed of the "Magnum Bonum" cauliflower should be sown during February in boxes, and the plants raised in a moderately heated greenhouse or frame, then planted out during the second week in April in a single line at a distance of 18 in. from plant to plant. A pair of Cos lettuce plants, also raised previously in a greenhouse or frame, as advised for cauliflowers, should be planted about 6 in. or 8 in. apart midway between the cauliflower plants. Radish seed sown as in Series 2 completes the preparation and the glass may be put over at once. A month later the radishes will be fit to gather and the glass may be removed for Series 4.

(*b*) Cauliflowers, kidney beans, and radishes. Cauliflowers and radishes as for (*a*), and kidney beans instead of lettuce between the cauliflowers.

Series 4.—Glass in use mid-May to early June.

(*a*) Vegetable marrows, lettuces and radishes. Three marrow seeds should be sown at every yard along the centre of the 15 in. strip of land. Lettuce plants and radish seed as in Series 3.

(*b*) Tomatoes. The plants should be about 4 in. high, raised from seed sown at the end of March in a moderately heated green-house, a single row being planted under each line of glass, the plants being 1 ft. apart. Suitable varieties are *Balch's "Filbasket" and Lister's "Prolific."* The glass should be removed as early as possible in June, and all side shoots should be cut out and the leader stopped just beyond the leaf above the third truss of bloom. The plants should be tied, watered, and fed as usual. (Note the empty pots inserted in the soil for watering, Fig. 2). Over 3 cwt. of ripe fruit were gathered from one hundred plants during 1914 at Northampton.

Series 5.—Glass in use during June and July, if necessary.

(*a*) Cucumbers. Excellent crops of the varieties known as "King of the Ridge" and "Cheltenham Long Ridge" have been produced at the Northampton Demonstration Plots. The plants were grown "on the flat" instead of on a ridge, and the glass remained over the crop for about three weeks. In preparing the land a heavy dressing of short stable manure should be used.

(*b*) Melons. The "Canteloupe" variety is most suitable. Excellent crops but poor prices were realised in 1913.

(*c*) Aubergines (egg plants). The first trial in 1913 yielded an excellent crop, but it was very difficult to sell in Northampton.

(*d*) Sugar Corn (maize cobs). This crop has always done well under these conditions, and there is a growing demand for the cobs.

The plants for this series must all be raised in a heated green-house or frame, and a single row of each should be planted under each line of glass. Cucumbers and melons should be 3 ft. apart, aubergines about 2 ft., and sugar corn about 18 in. apart.

Chillies and capsicums were both included in this series in 1915, but neither crop did well, and there is practically no market for the fruits in this district.

The crops in this series can usually be grown on the land which was previously used for Series 1.

Series 6.—Winter Crops.

(*a*) Parsley, sown in July, (*b*) Violets, (*c*) Christmas roses (*Helleborus niger*).

The usual methods of cultivation may be followed for this series, and the glass can be allowed to remain over the crops until required for Series 1 in the new year.

The apparatus is also very useful for protecting flowering bulbs such as narcissus, etc., but for these the glass should be reversed so that the 18-in. side is vertical instead of horizontal. Half-hardy annuals, such as asters, may be easily raised under the apparatus, and the seed should be sown about a month before the plants are required for bedding out. Of the crops mentioned above, very few remain under the glass for more than a month, the idea being to protect the plants during critical periods and to remove the glass as soon as the climatic conditions are favourable.

Watering, etc.—Watering is seldom necessary during the early months of the year; a good soaking should be given before fixing the glass when the plants are transplanted. However, in the case of Series 5, watering is sometimes necessary in the case of tomatoes (Series 4). The water may be given through the space between the glass at the top without removing the apparatus, and empty flower-pots should be sunk in the soil between the plants to take the water.

Many of the plants mentioned in this article must be grown for a short time in a moderately heated green-house or in a frame on a hot-bed of manure; but the smallest green-house will suffice to raise plants for a very large area, as the heated structure is only necessary for the purpose of germinating the seeds and of carrying the plants through the seedling stage. No transplanting need be done until the plants are pricked out into their final quarters under the apparatus.

A point of great importance, in view of the present difficulty in obtaining labour, is the fact that the apparatus requires practically no attention from the time when it is fixed over one series of crops until the time when it has to be removed to the next series, whereas in the case of ordinary hand-frames and cloches, ventilation and watering entail a vast amount of labour almost every day. Another important point is that raised hot-beds are not necessary except for seed germination, as mentioned above, and this means that a comparatively small amount of stable-manure is required.

THE DESTRUCTION OF FARM VERMIN.

In connection with the need for maintaining home-grown food supplies all agencies which tend to destroy food should receive very careful consideration. There are several birds and four-footed animals which are commonly regarded as pests of agriculture and may be grouped together under the name of "farm vermin." For the purposes of this note this term may be widened to include foxes, hares, rabbits, rats, mice, voles, rooks, sparrows and wood-pigeons. It is important that all these in most districts, and larks, partridges and pheasants in many districts, should be effectively reduced in order to prevent the excessive loss of poultry, grain, clover, roots, etc. which they need for their support.

Articles and notes have already appeared in this *Journal** dealing with the destruction of farm vermin, but it is imperative that action should be vigorous and repeated if success is to be attained in adequately reducing pests and preventing heavy loss, and this fact supplies the reason for further allusion to the subject.

One of the Board's leaflets (Special Leaflet No. 52, *Destruction of Farm Vermin*) was reprinted in this *Journal* in February last, p. 1162. It deals with rats, mice, sparrows, rooks, larks, wood-pigeons, rabbits and foxes. It may be added that rats are more fully dealt with in Leaflet No. 244 (*The Destruction of Rats*), sparrows in Leaflet No. 84 (*The House Sparrow*), and voles in Leaflet No. 6 (*Voles and their Enemies*). Copies of any of the four leaflets mentioned may be obtained free of all charge on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W., and the letter or postcard of application need not be stamped.

With regard to hares, pheasants and partridges, it may be urged that wherever it is quite clear that they occur in excessive numbers, and are causing real loss of crops, they should be unhesitatingly reduced and placed on the market, where they will to a very useful extent replace the meat of ordinary live stock. This remark also applies to rabbits and wood-pigeons, both of which form an excellent meat diet and might be much more widely used than at present. At certain seasons, indeed, wood-pigeons might be secured in immense numbers, to the direct advantage of the consuming public and to the improvement of agricultural production.

* See this *Journal* for February, 1916, p. 1162 ("Destruction of Farm Vermin"); March, 1916, p. 1238 ("Destruction of Rats in East Lothian"); May, 1916, p. 157 ("Suggestions for the Destruction of Wood-Pigeons"); and p. 159 ("Tring and District Sparrow Club").

Stoats and weasels are deserving of special consideration. They are among the deadliest and most persevering enemies of small rodents, of which they kill far more than they can devour, apparently out of sheer blood-thirstiness. In woodlands and on low ground much harm to game is done by them, especially the stoat, which preys on mice, voles, rats, rabbits, leverets, and young game birds and poultry. The weasel is a persistent enemy of rats, mice and voles, while it also takes rabbits and leverets. Neither the stoat nor the weasel, however, should be permitted to destroy poultry.

It is, perhaps, hardly reasonable to expect that stoats should be allowed to multiply unduly in game-coverts, or in the vicinity of pheasant coops and poultry runs, but the Board have no hesitation in recommending that weasels, which are persistent mouse-hunters, and do little damage to game, should not be molested, at least in moorlands and hill pastures, where they can do little harm and much good. The stoat and weasel are illustrated in Leaflet No. 6.

Co-operative Destruction of Farm Vermin.—The principal methods of destroying the more troublesome forms of vermin are indicated in Special Leaflet No. 52, referred to above. It must be emphasised, however, that the destruction of vermin is essentially a matter for local effort, which should not be isolated or unsystematic. The most determined efforts to keep down the numbers of vermin on a particular farm may be of little avail if the pests are allowed to multiply on neighbouring farms. Occupiers of farms or buildings should, therefore, join together with a view to making a systematic attempt to reduce the pests over as large an area as can be conveniently dealt with. Clubs, similar to those suggested in Leaflet No. 84 for the destruction of sparrows, might be formed, and local agricultural and horticultural societies of all kinds should take advantage of their favourable position for initiating concerted action among their members, and introduce schemes for the destruction of vermin. Clubs formed should secure all the assistance possible from landowners, farmers and others locally interested Farmers and landowners might well be leaders in forming clubs for the reduction of pests, in the manner which has already been successfully adopted in many districts.

As an instance of concerted effort for the destruction of rats, a plan carried out in East Lothian may be cited.* Subscriptions collected by the East Lothian Farmers Club covered in 1909 the cost of employing four rat-killers to " work " the whole

* *Journal*, March, 1916, p. 1238.

county, and in 1910 two men were so employed; in 1911 the County Council took over the work and engaged seven rat-killers; in 1912, on account of a reduction in the area comprised in the scheme, the number was reduced to three, but these men were employed for the whole year. In the six years 1909–1914 116,857 rats were killed, 70,000 of these being accounted for in the last four years. The plan is to divide the area into districts consisting of from 25 to 30 farms, and to allot a district to each rat-killer, who is provided with ferrets, dogs and traps. The man begins with the outer farms in his district and gradually works towards the centre.

The Tring and District Sparrow Club* furnishes an example of a successful attempt to combat the pest. The members of this club are paid at the rate of 3*d*. per dozen head of sparrows killed within a four-mile radius of Tring, and in the first two years of its operations (1914–15 and 1915–16) 23,445 sparrows were killed.

A sparrow club has been established at Angmering, West Sussex, for over 70 years, and in 1911 it was amalgamated with a rat club. Members pay a subscription of 1*s*. per annum, and a certain number of sparrows and rats was allotted to each farm, and if the allotted numbers were not caught a fine of 1*s*. per dozen was imposed. The numbers decreased so far that in 1913 this fine was reduced to 6*d*. per dozen. The fines paid the expenses and also for prizes for the highest and second highest numbers of rats and sparrows beyond the number allotted. The rats decreased so considerably that for the largest farm, to which 60 dozen rats had been allotted, the number allotted had to be reduced to 30 dozen.

A sparrow and rat club has existed at Slinfold for some years. In 1915 were caught 722 rats and 1,083 house sparrows, while 509 sparrows eggs were taken. The total head of vermin caught to the end of 1915 amounted to 84,590, and 17,201 sparrows' eggs had been taken.

In the year 1915 the Ixworth and District Sparrow Club accounted for the destruction of 14,669 sparrows and eggs, a decrease on 1914, stated to be owing to the exceptional circumstances of the time. The total expenditure for the year amounted to £24 15*s*. 4½*d*., of which £19 7*s*. 11½*d*. was for sparrows and eggs; and the society had a balance to carry forward for 1916 of £10 1*s*. 1¾*d*.

Local "Shoots" of Rooks, Wood-Pigeons and Rabbits.—In addition to aiding the formation of local clubs for the destruction of vermin, farmers might also approach landowners and

* *Journal*, May, 1916, p. 150.

shooting tenants to urge upon them the need for reducing foxes, hares, pheasants and partridges, and to secure their permission to organise local "shoots" of rooks, rabbits and wood-pigeons wherever these are doing real damage to crops. Where objection is made to such "shoots" on the score of disturbing game, it should be pointed out in reply that the maintenance of production in regard to ordinary farm crops is of more importance to the country than the maintenance of game, and that the Board very strongly deprecate any action which in the least tends to preserve the latter at the expense of the former.

Prizes for the Destruction of Rats and Sparrows.—A further means by which landowners and farmers may aid in the destruction of rats and sparrows, especially where clubs exist for the purpose, is to offer prizes for the largest numbers destroyed. It is possible that reasonably good money prizes might serve to stimulate serious endeavours to reduce the numbers of pests.

Voluntary Local Rate.—A point which is deserving of full consideration by Local Authorities is that of the possibility of levying a local voluntary rate for the destruction of rats, with the object of preventing disease and reducing the damage done to crops and stored produce.

Poisoning of Rooks and Sparrows.—The Protection of Animals Act, 1911, regulates the use on land of poisoned grain, and provides that it shall be a defence that it was placed for the purpose of destroying rats, mice, or other small vermin, and that all reasonable precautions were taken to prevent access thereto of dogs, cats, fowls, or other domestic animals.

Although there does not seem to be any decision of the Courts as to the meaning of "vermin" in this connection, the Board are of opinion that it would be held to cover the sparrow. Many suggestions have been made that rooks and sparrows should be destroyed by feeding them in the open with poisoned grain. The Board, however, are not prepared to advise this step, since it would be quite impossible to guarantee protection for other birds, which would be liable to destruction at the same time.

EGG PRODUCTION.*

W. G. TARBET.

A KNOWLEDGE of the details of poultry-keeping is perhaps less essential at the outset than a clear understanding of the

* This article is an account of methods adopted by the author, and is likely to be of interest to large producers. The Board cannot, however,

first principles of egg production. Methods may vary, and each be attended by equally good results, but if the first principles are violated the full returns from the undertaking are never likely to be achieved.

Egg production is merely a process of raising certain foods to a higher cash value. As in every other manufacturing process any waste of time, money or material must be rigidly guarded against. The system used should be as well thought out as the organisation employed in any large manufacturing plant, and, like it also, should be capable of endless reproduction, without the least vestige of any change.

The capital employed must be only such as will give the greatest efficiency with the least expenditure. The labour employed must be paid at a rate relative to the work done, *i.e.*, highly-skilled and highly-paid labour must not be used for unskilled work, and no male unskilled labour should be employed when cheaper boy labour is adequate and available.

In order to carry out the process of egg production a satisfactory supply of labour is essential. To secure and to retain this, it is necessary that the conditions and hours should be reasonable and, therefore, the plant and the working system should conform to this principle. In every manufacturing process it has always been found a paying proposition to make the conditions as agreeable as possible for the workers.

As the cost of supervision is high it is essential that the plant should be so arranged as to reduce the time required for supervision to a minimum, so that one skilled person, preferably the owner, may be able to satisfy himself in a reasonable time each day as to the condition of the plant.

The process of the conversion of cereals, milling offals, and meat or fishmeal into eggs requires the economical use of the hen. On a large scale, in ordinary years, it was formerly possible to rear a pullet from shell to maturity at a cost, inclusive of everything, of 3*s*. 6*d*. Since the War this cost has risen very much, and at present rates it is difficult to rear pullets for less than 6*s*. each, when the rearer is largely dependent on purchased foods and paid labour. Taking the latter figure as the cost, the "machine" for the conversion of cereals, etc., into eggs is 6*s*.

Housing for one year will cost, inclusive of upkeep and depreciation, a little under 1*s*. per bird. (The houses used by the writer are calculated to have a life of 10 years, and the cost is based upon this period). Labour at £100 a

year and supervision at £150 a year will cost 2*s.* 6*d.* per bird. Rent of land, excluding crops, will amount to about 6*d.* per bird. Thus, the total cost of "machine," plant, labour and rent for the first year is 10*s.*

The cost of feeding pullets, at present prices (November, 1916) is just under 2¾*d.* per week. This figure includes shell and grit and also an ample supply of green-stuff in the relatively expensive form of cabbage. The total sum is equal to 12*s.* per annum, and we therefore arrive at the figure of 22*s.* as the inclusive gross cost of the pullet during its first year's full lay.

Considering the light breeds, Leghorns, Anconas, etc., pullets at the end of their laying year are worth 3*s.* each in the market, and, after making this allowance, it will be seen that the net cost for twelve months is 19*s.* It is as well to make the foregoing adjustment, as, even if the pullet is not sold, but retained for another year's laying, it is hardly worth more than 3*s.* for egg production only, in comparison with a pullet at 6*s.*

The cost of egg production amounting to 19*s.* per bird, the sale price of the eggs and the number of eggs laid may be held to determine the profit or loss. The price per egg is easily ascertained by taking the average throughout the year ending October, 1916, and making allowances for the lower price on the heavier outputs. Based upon the writer's own farm and production the price per egg averages over 2*d.*, but it is only fair to state that while, on the one hand, the writer's output was high, the price obtained for a large number was lower than the market price, the hospitals having had the benefit of the reduction.

Taking the value of the egg at an average of 2*d.*, the average number laid is the only remaining factor required to determine the profit and loss account. It is here that the value of close supervision will affect the aforesaid account. From the multitude of figures supplied so freely by some vendors of stock, chicks and hatching eggs it would seem to be a common occurrence for a pullet to lay 200 eggs in the year, and that this number can safely be relied upon. That such is not the case hardly requires emphasis. No matter how well selected, and how well mated the stock, where every advantage is taken of the recent discoveries of the inheritance of high fecundity, there are always pullets the high fecundity of which is either masked or non-existent—in other words there are always poor layers, and it is only by employment of close supervision that

a high average can be obtained. By expert supervision it is possible to obtain from a comparatively large number of pullets, say 500, an average of 180 eggs per annum. By ordinary intelligent supervision it is quite possible, granted good stock, to depend upon an average of 144 eggs per bird per annum, which at *2d.* per egg are worth a gross sum of *24s.*, equal to a net income of *5s.* per pullet.

The foregoing figures would be of little value if they were merely the result of hearsay, but they are drawn from actual practice upon a large scale. They are, therefore, of great interest in showing how closely the first principles of egg production must be followed. The organisation must be as perfect as that required for success in any other business, or good results will not be obtained.

For example, suppose that 2,000 pullets were required. They would represent the expenditure of £600. If through inferior management only 1,500 pullets are brought into the laying quarters each pullet will have cost considerably over *6s.*, and the net profit for the year will have been much reduced. It is thus quite apparent that the ability to bring into their laying quarters at a certain cost, and without fail, a pre-arranged number of pullets each year lies at the very root of success in egg production. The birds cannot be secured by hatching excessive quantities of chicks and trusting to the survival of a certain number in spite of a heavy mortality. Normally four eggs are required for every pullet reared, allowing for mortality and selection at all stages. At *3d.* per hatching egg this means *1s.* per pullet. If, owing to greater mortality, the number of eggs required for each matured pullet is increased to eight this would mean the extra expenditure of £100 for 2,000 pullets, or, in other words, a reduction of *1s.* net profit per pullet.

So important is this question of chick rearing, when egg-production on a large scale is contemplated, that the writer would put it forward as *the* problem of egg production.

The ability to organise a successful system of rearing, using practically unskilled labour throughout, is one that can only be gained by personal application to the subject. The appliances advertised, good in their way, are hardly applicable to economic and successful rearing on a large scale. The labour involved is too great, and the results are too dependent on the attention of the attendant, who must of necessity be constantly exposed to the weather. To go to the other extreme, a brooder-house in unskilled hands is liable to give

unsatisfactory results, although effecting a saving in labour, and although comfortable for the attendant. There is also the objection that, as the brooder-house is necessarily a permanent building, the outside runs gradually lose their freshness.

The plan devised and practised on the writer's farm represents an attempt to solve this problem. This plan consists in the employment of houses similar to those used for the laying stock, with a raised floor of earth or ashes, and a simple heating arrangement inside. These houses are of simple pattern, giving 72 sq. ft. of floor space, with full head-room for the attendant. Placed in rows they greatly reduce the amount of travel required, and make supervision easy. Divided into such comparatively small units, and isolated, they render more local the effect of any fire, accident or epidemic. Brooded in one of these houses, reared in another of exactly the same type and size, and the laying quarters being of precisely similar pattern, the birds suffer little from the changes necessary, and this is a marked advantage. On a large scale the houses are economical; their construction offers no difficulties; they are portable; and with only minor alterations they can be kept in use the whole year round.

One of the essentials of economic chick rearing is the provision of hatching eggs from good, healthy stock. The difficulty found in procuring these when starting egg-production is the primary cause of many failures. It should be possible, paying a fair price, to get eggs which will give a fair percentage of strong chicks capable of being reared to maturity with a very small proportion of deaths. It is, however, still difficult to attain this, and the only suggestion that the writer can offer is that the purchaser should see for himself the condition in which the stock birds are kept and how they are fed. Stock which are kept on apparently fresh land, which are fed on good, sound wheat and oats, with not more than 10 per cent. of meat-meal, blood-meal or fish-meal in the milling offals, and which appear alert, clean-feathered and of average weight for their breed, are likely to prove satisfactory as regards eggs for hatching. It is natural to suppose that on a poultry farm, the income of which is dependent on egg-production for the market, the owner's desire must be to obtain the best results possible, and if surplus eggs from such a farm can be purchased the buyer starts reasonably well.

Given good, sound stock to commence with, a well-organised system of rearing chicks up to eight weeks old, and a free

life on a fresh field, the resulting pullets will come into their laying quarters in a fit condition to render a good account of themselves. How good an account this will be depends not only on their vitality, but upon their inheritance of high or low fecundity—a matter which is becoming better understood, and which must be well studied in connection with egg production.

The management of the laying stock offers no difficulties that intelligent understanding of the first principles of egg production previously outlined cannot overcome. Rigid routine; cleanliness; and plain, rather spare feeding, with abundance of green food; these are the requisites that make for success. That success is possible when these principles are put into operation is becoming every year more evident.

ECONOMY IN USING POTATOES.*

IN view of the high price of potatoes and the small crops produced in many parts of the country, it is essential that all consumers should practice strict economy in their use. Apart from the question of eating fewer potatoes, very considerable economy may be effected by careful, intelligent cooking. Let us consider for a moment the construction of the potato. Investigation† has shown that the potato is made up approximately as follows:—

(1) Skin	2·5 per cent.	
(3) Flesh	89·0 "	edible portion.
(2) Layer next to skin ...	8·5 "	

The edible portion contains about 75 per cent. of water, so that only about 25 per cent. is of direct value as food. Further, the richest part of the potato is that next the skin.

Trial has shown that the most common method of cooking potatoes—paring and then boiling after placing the pared tubers in cold water—is the most wasteful method practised. This is so for three reasons:—

(*a*) Not only the skin, but the surface layer and perhaps 10 per cent. of the "flesh" are removed by thick paring, partly owing to deeply-sunk eyes and surface

* This article is being issued as Special Leaflet No. 67, and, as it appears here, copies of the leaflet will not be sent, as is usual, to subscribers to the *Journal*; copies can, however, be obtained at once on application in the usual way.

† Potatoes and other Root Crops as Food: Farmers Bull. 295, U.S. Dept. of Agriculture.

irregularities: the total loss may, indeed, amount to as much as 20 per cent. of the whole tuber—or 1 lb. in every 5 lb.

(*b*) The surface layers, which are wasted, contain a larger percentage of solids than the remainder; and

(*c*) The subsequent boiling dissolves out soluble ingredients of the potato, and also breaks down the surface into the water—which is thrown away.

Experiments on the subject showed that pared potatoes put into cold water and boiled lost 15·8 per cent. of their protein or flesh-forming substances, 18·8 per cent. of their ash or mineral matter, and some 3 per cent. of their carbohydrates or starch. Plunged at once after paring into boiling water and boiled they lost 8·2 per cent. of their protein, about 18 per cent. of their ash and a small amount of their starch.

On the other hand, *when boiled in their jackets*, potatoes lost only 1 per cent. of their protein, a little over 3 per cent. of their ash, and practically none of their starch, whether plunged in cold or hot water at the start.

It is clear, therefore, that if pared potatoes are placed direct in boiling water the loss in boiling is very much reduced compared with the usual method—placing in cold water; steaming instead of boiling also reduces the loss; while boiling or steaming in their jackets reduces all losses to a minimum—both the "boiling losses" and the primary 20 per cent. loss due to paring are almost wholly avoided.

When potatoes are partially diseased they must of course be pared in order to remove the affected parts.

Considering the facts already outlined, the following points may be taken as maxims in economising potatoes:—

(1) In cooking for the table *potatoes should be boiled or steamed in their jackets: this will reduce the loss to a minimum.* To facilitate the escape of steam and prevent the cooked potatoes from becoming "stodgy" it is useful to make a cut in the skin of the tubers at each end.

(2) In baking potatoes slow cooking is desirable, so that the skin does not "bake on" to the "flesh," and so cause loss. The skin should be pricked or cut before baking to permit the escape of steam. Proper baking of potatoes involves little if any greater loss than boiling in their jackets.

(3) If because of injuries to the surface, or for any other reason, potatoes must be pared, they should be cooked by steaming, or by cooking in the smallest possible quantity of water, which should be boiling when the potatoes are put in. The water

should be used as a basis for soups, for which it is quite suitable. The loss in boiling is reduced if salt is added to the water.

(4) A better plan even than that last mentioned is to pare the potatoes as thinly as possible and use them, after slicing, for vegetable or meat pies, with or without a pastry crust. Potatoes should also be pared very thinly when used for soups.

(5) Where a bulky vegetable food is required the potato may usefully be replaced by turnips, especially swedes, which should be sliced and steamed rather than boiled. If boiled, the minimum of water should be used, and the liquid should afterwards be made into soup.

Consumers of potatoes, who are also growers, should, in addition, note the following points with a view to economy:—

(6) Potatoes should be stored when dry in a cool, dry place, where loss from "rotting" is likely to be reduced to a minimum: not where they will "heat" or "sweat." A sprinkling of powdered lime or sulphur will aid in preventing the spread of disease.

(7) Enough seed for planting should be reserved in case seed is not available in spring; but if the 1916 crop was not the produce of seed from a northern climate, an effort should be made to secure seed from Scotland or the North of Ireland for 1917. (See also Leaflet No. 173, *Potato Growing*, and Leaflet No. 296, *Potato Growing in Allotments and Small Gardens*.)

(8) All small potatoes not required for seed should be used for household food as far as possible; the very small ones, as well as those which are diseased, should be used, after boiling, for pigs and poultry.

Work of Women on the Land.

A NUMBER of cases have already been published in this *Journal** as examples of the way in which women of all types have demonstrated the value of the services they can render to farmers in the present national emergency, if farmers will only give them a fair trial and such preliminary instruction as may be necessary. Further instances of successful women's labour in agriculture are given below, and in the articles at pp. 879 and 881.

(1) An interesting example is that of a farm in Gloucestershire. Women first commenced to work on this farm at the beginning of June, 1915. The working day was divided up into three sections, viz., 8 a.m. to 11.30 a.m., 12.30 p.m. to 4 p.m. and 4.30 p.m. to 8 p.m. The women worked for as

* August, 1916, pp. 462 and 492; July, 1916, p. 349; May, 1916, pp. 139 and 143; April, 1916, p. 75; January, 1916, p. 1006, and December, 1915, p. 850.

many sections as suited them. During the summer of 1915, 15 women and girls were working regularly and 8 or 9 continued to work through the winter. None of them had done any farm work before; their ages ranged from 17 to 65. They weeded about 100 acres of corn, cut all the thistles in the grass land, and hoed, singled, pulled and pitted about 40 acres of roots.

During 1916 more women were employed, altogether about 40. They singled all the turnips and have milked a herd of about 80 cows daily in addition to refrigerating and bottling the milk. They also helped to feed the cattle and clean out the byres and took entire charge of the feeding of young calves.

Owing to the fact that female labour was introduced early in the War, it was possible on this farm to grow as much food as in normal years, and even to increase the acreage of corn.

(2) In the case of a farmer in Bucks, work done by women has enabled him, taking the bad weather into account, to do excellently with mangolds, swedes, etc., so that he has as good crops as he has ever had, and is able to keep, without fear of running short of food, his usual number of sheep and cattle. With plenty of women's labour he has also got in his hay and corn harvest very well on the whole, and he remarks that without the help of women he could not have got his corn land free from weeds in the spring, nor could he have secured such good crops of roots all over the farm as he has done.

As many village women can only devote a portion of their time to farm work, it has been found an advantage to organise gangs under a skilled leader who gives her whole time to the work, and is responsible to the farmer for the payment and work of the women. This arrangement economises the time spent in instruction and enables women totally unaccustomed to farm work to be immediately useful with practically no waste of time in training.

(3) One instance of this was recently reported in this *Journal* (August, 1916, p. 462) by Mrs. Doris W. Stapledon, work being conducted in Wales by a gang of girls, chiefly recruited from the University College of Wales, Aberystwyth.

(4) In another case a lady in Herefordshire organised a successful gang of women farm workers from among those who had registered through the various parish canvassers in Hereford City.

She began with five women, and herself worked with them and helped to train them. The women had had little or no experience of farm work, but were chosen on the understanding that they would be prepared to do any sort of work suitable for women. They worked from 9 a.m. to 1 p.m. and from 2 to 6 p.m., and were given 3*d*. an hour.

The farmer who first employed them put them to weeding corn, and by the time this was finished they were getting accustomed to the outdoor life and better able to manage the work. From there they moved to another farm under the supervision of a local lady, where they have been employed in weeding the clover retained for seed, cutting the rough grass along the hedgerows in a field, and weeding the corn.

Two other gangs were arranged, one of six and one of four, under the supervision severally of a local squire and his wife. The farmer employing the six has found the women useful in hoeing and singling mangolds, hoeing and cleaning a large garden, turning clover, hay, etc. The gang of four have been hoeing mangolds.

(5) The following instances of successful gangs are given by a correspondent in Devon, who has herself acted as leader, doing work with the women, keeping the time for each and making all arrangements direct with the farmer:—

(*a*) A gang of 6 women weeded two fields of corn, 8 acres and 4 acres. The 8-acre field was fairly clean and the work was paid for at the rate of 1*s*. per acre. The 4-acre field was very foul, and payment was made at the rate of 5*s*. per acre. The farmer expressed himself as more than pleased with the crops, and later asked the gang leader to come and see the crop cut as it was the best he had ever had.

(*b*) A field of turnips very much out of hand was undertaken. The women cleared the weeds and singled the turnips; they were paid 18*s*. per acre, and tea was provided.

(*c*) Three women pulled 2 acres of mangolds at 12*s*. per acre, tea being provided. The farmer expressed himself surprised at the quickness of the women and was perfectly satisfied.

Four women pulled 2 acres of mangolds on the heaviest land in the parish at 14*s*. per acre, tea being provided. Two of them did ¼ acre a day each and earned 3*s*. 6*d*. each, working from 10 a.m. to 5.30 p.m., with ½ hour for dinner. The farmer said the work could not have been better done.

Two labourers' wives pulled 2 acres of mangolds at 12*s*. per acre in the worst November weather, and did it well.

None of these women had worked on the land previous to this year.

(6) In a Wiltshire village the daughter of the local squire offered herself as a pupil in farm work to a neighbouring farmer.

After learning to do the work well herself, she has led a gang of village women to provide much useful labour. The farmer for whom she works reports that she first undertook docking in the wheat, and ultimately, with her gang, relieved him considerably. Later, they undertook haymaking, clearing out couch and other light work, while Miss X has been milking all the summer in the mornings, and later both mornings and afternoons, and then helping in the dairy generally.

These instances are sufficient to show that women are capable of performing satisfactorily many forms of agricultural work, and that farmers will be well advised to enlist their help to replace the male labour they have lost or may lose later. The canvass of the women is showing that they are ready to offer their services, but the farmers must realise that in view of the large demand for women's labour in other industries, they cannot expect women to work on the land unless they are prepared to pay good wages.

THE following note has been communicated to the Board by Mr. W. R. Wintour, Instructor in Manual Processes in Nottinghamshire :—

Training Women for Farm Work in Notts.

Two training centres for women were started in Nottinghamshire during the third week in June, one at Welbeck Abbey,* on the estate of His Grace the Duke of Portland, K.G., and the other at Colston Bassett, on the estate of Mr. R. M. Knowles.

The training at each centre extends over a period of three weeks. The students receive 3*s.* 6*d.* per week, with free board, lodging, tuition and uniform.

The Welbeck Training Centre provides residential accommodation for 20 students, who live together in a hostel, kindly lent by His Grace the Duke of Portland. The students rise at 5.30 a.m. for milking, breakfast at 7 a.m., after which they work on the home farms in batches of threes or fours. The dinner hour is 12.30 to 1.30 p.m., and work ceases at 5 p.m.

At Colston Bassett there is accommodation for 15 students, who lodge in the cottages close to the home farm and have their meals in the mess room at the farm. The home farm of 661 acres is under the management of Mr. G. H. Elliot, who personally supervises the work of the pupils. Milking is a very important part of the training. It is taught first on a very useful invention, "The Artificial Udder." Each student practises for about one hour every day, and, when

* This Centre is now closed.

transferred to the real cow, she finds milking is quite easy. In addition to milking, the pupils feed pigs and calves, and clean out their houses, hoe and single roots, work the binders and assist generally in harvesting and haymaking. Some of them have become efficient thatchers, They have learned to plough and, in fact, to take part in most seasonal operations. Opportunities are given them to acquire some knowledge of butter-making and poultry-keeping.

About 116 students have been trained and placed on farms in the county, and, generally speaking, have given entire satisfaction. Very few of the pupils had any previous knowledge of farm work, being formerly mostly engaged in industrial occupations; but with suitable facilities for training at their disposal, they soon acquired some familiarity with general farm work.

The farmers in Notts are beginning to appreciate the value and importance of this movement, but, as there has been a heavy call for female labour in this vicinity for making munitions, the supply of women available for farm work is decreasing. An endeavour is, therefore, being made to draw upon girls from other counties.

On the whole it is felt that valuable work is being done, not only for the present emergency, but for the needs of agriculture in the future.

Many of these town-bred girls openly express preference for *their new mode of life, and it is reasonable to suppose that* some at least of them will permanently settle in the country.

The financial arrangements at both centres are more or less similar. At Welbeck, in addition to quarters, the Duke of Portland provides gas, coal and water free of cost. The Committee has expended about £140 on furniture, with the prospect of its being taken over for other purposes by the County Authorities after the War. The weekly cost of food works out at about 8*s*. 9*d*. per pupil, and a woman is employed to cook and clean at 18*s*. per week. The matron receives a salary of £105 per annum, and the wages paid to instructors have amounted in something over four months to £28. In the same period a total of £9 has been received from farmers in lieu of providing meals for the pupils who work on their farms. At Colston Bassett, as stated above, there is no central residence, the pupils being lodged in labourers' cottages on the estate at a weekly cost of 4*s*. per head. Mrs. Elliot, the hon. matron, supervises their meals, the mess-room being attached to her house. The instructors, skilled farm-workmen, receive 1*s*. 6*d*. per pupil weekly, each being responsible

Cleaning and Littering Stables.

Using the Self-binder, with Three Horses.

Training Women for Farm Work—Stapleford Training Hostel, Hertford.

THIS Hostel, which is under the management of a sub-committee of the Hertfordshire Women's War Agricultural Council, has been open for the residence and training of girls in farm work since early in June. The Hostel consists of a furnished house, lent for the purpose by Colonel and the Hon. Mrs. Abel Smith, who is chairwoman of the Hostel Committee; and the modest expenses, amounting to less than £1 per week per pupil, are defrayed by the Hertfordshire Agricultural Education Committee.

The course lasts six weeks, during which period the eight pupils are maintained free, being able after their first two weeks to earn up to 5s. a week for work done for farmers. After completing their course they usually earn from 15s. to 20s. a week.

An instructress supervises both the comfort and the general training of the girls. Their more special instruction in milking they receive under experienced cowmen at farms in the immediate neighbourhood, only two girls being allotted to each farm. This practice has been wisely adopted to save the cows from too large a number of prentice hands. At these farms they are also initiated into cleaning out sheds, preparing food, feeding calves and pigs, driving carts to the train and the daily routine of light field work.

Before entering the Hostel the girls sign an undertaking to work in the County of Hertfordshire for six months after the completion of training, and during that period are to a certain extent responsible to the Hostel Committee.

The Committee takes every care that girls shall be placed on suitable farms, and is at present receiving more applications for trained milkers than it can supply.

The scheme has so far been very successful. In most cases the girls have been able to milk 8 to 10 cows by the end of their period of training, and have become accustomed to the life. The readiness of farmers to take successive pupils shows that they are of use even whilst training.

Up to the end of October, 23 girls had completed their training and of these 20 have been placed on farms; one has been sent to take a course in dairy work at the East Anglian Institute at Chelmsford, and the remaining two proved unsuitable.

The Hon. Secretary to the Hostel is Miss L. Puller, Youngsbury, Ware, who has kindly supplied the information on which this notice is based.

THE following notes on culinary herbs have been contributed by Mr. W. Dallimore to the Kew *Bulletin of Miscellaneous Information*, No. 8, 1916.

Culinary Herbs in Lancashire.

A good deal of attention has been paid during the last few months to the cultivation of medicinal herbs, but little notice has been taken of the cultivation of flavouring or culinary herbs, although it is an industry of some importance amongst cottagers and small farmers in the neighbourhood of certain large towns. In south-west Lancashire such herbs are very popular under the name of pot-herbs and they find a ready sale in Liverpool, Bolton, Manchester, Bury and many other places.

During the autumn of 1915 an opportunity occurred of visiting a number of farms and cottage gardens in the Lancashire villages of Maghull, Lydiate, Aughton, Scarisbrick and Narrow Moss, where pot-herbs are well grown, and the following notes are based largely upon information gleaned during that visit.

The work appears to be confined to small farms and cottage gardens, farmers with large holdings rarely troubling about the business. In some instances cottagers specialise on the work, whilst in other cases a few beds of herbs are included amongst other market crops. Very often the work of cultivation and preparation for market is left almost entirely in the hands of women, the wives of farm servants accepting it as part of their home work. In other cases the cultivation of pot-herbs is included in the routine of the ordinary work on small farms, but even then much of the work is left to women.

The herbs most in demand are thyme, sage, marjoram, mint, and parsley. The soil in that neighbourhood is generally light, and it is usually heavily manured for potatoes or some other crop before being planted with herbs. As a rule the herbs are planted in beds about 4 ft. wide, for convenience of handling, although wide breadths are sometimes seen.

Thyme is very popular, and two kinds are grown, one of annual duration, the other perennial, and they are known respectively as "annual" thyme and "stock" thyme. Seeds of the former are sown out-of-doors in spring and gathering commences as soon as the plants show signs of flowering. The plants are cut over close to the ground or pulled up by the roots and tied in small bundles, a bundle being as much as can be conveniently grasped in one hand. The stock thyme is increased each spring by division. Small plants are put out in March which, by the end of summer, are a foot or more across. Gathering begins as soon as the annual kind is over. The plant

are cut down to the ground and the roots are afterwards ploughed up, the necessary number of plants for division for the following year's crop being retained. Both thymes were identified at Kew as forms of *Thymus vulgaris*, L.

Sage of two kinds is also grown under the names of "annual" and "stock" sage. The first-named is grown from seeds sown in spring, the other from layered branches or sometimes from cuttings. Annual sage is collected when fully grown but before the flowers open if possible, and the stock sage is reserved for later use. As in the case of thyme the best results are obtained from young plants. Both sages are forms of *Salvia officinalis*, L. In one or two cases a purplish-leaved form of sage was noted, but it was not general.

Marjoram or "Sweet Marjoram" (*Origanum Marjorana*, L.) is grown from seeds sown broadcast in beds in May. The crop is collected towards the end of summer just as the plants are coming into flower. It is almost as popular as thyme for flavouring purposes and large quantities are grown. When collected it is tied in bunches like thyme and sold wholesale at from 5*d*. to 9*d*. a dozen bunches.

Mint (*Mentha viridis*, L.) is not grown by so many people as are the other herbs, but is usually in larger areas. The shoots are collected from early spring to late summer and some people lift plants and place them in frames in late autumn so as to advance growth during early spring. Plantations are not allowed to stand long on the ground, better results being procured from young stock. When forming plantations rooted shoots are dibbled into well-worked land during moist weather in spring.

Parsley is usually sown broadcast in beds, sometimes alone but often with onions, the onions being pulled early and the parsley left to form the main crop. Formerly, other herbs were cultivated, such as pennyroyal, horehound, tansy, chamomile and wormwood, but it is said that there is very little call for them now, and they are not grown in quantity in the district in question.

Marketing is almost entirely by the bunching method, a bunch being as much as can be conveniently grasped in one hand, and the growers usually sell wholesale, sometimes to buyers who visit the gardens, but more often in the open market. Much of the produce is sent to market by road, cottagers usually arranging to send small quantities on neighbouring farmers' carts, the farmer or his agent acting as seller. Prices vary from time to time. Last September, thyme, sage and marjoram were selling wholesale at from 5*d*. to 9*d*. a dozen

bunches, whilst in the retail market at Liverpool from 1*d*. to 1½*d*. per bunch was asked. Some growers have erected drying sheds and, when prices for green herbs are low, they dry their produce and store it until better prices can be obtained. Other growers supply regular customers, and one man stated that he supplied a considerable quantity of dried herbs to certain shipping companies.

Although the business is not one for indefinite extension it is well worth the attention of small holders in the vicinity of large towns, for, apart from the actual preparation of the ground the work is not difficult and can be conducted by women and children. Whether it would pay to cultivate any of these subjects, or others, such as lavender and peppermint for the distillation of oil, would be a matter for experiment in particular districts, but for such work it would appear that success could only be expected by a proper system of co-operation amongst the growers.

During his visit Mr. Dallimore was greatly impressed by the general good cultivation of the crops, which was particularly noticeable on a number of small holdings, each about one Cheshire acre (a little more than two English acres) in extent, at Narrow Moss, and on a farm near by. These small holdings were excellently cropped and very clean. The tenant of one stated that his was worked entirely by the spade and his only assistant was an elderly female relative. The greater part of the land was given over to thyme, sage and marjoram, and his produce was marketed in several towns mostly to regular customers. In the other case a portion of a farm was given over to herb and flower cultivation. The preparation of the land was done as far as possible by horse labour, the remainder of the work being carried out by one of the farmer's daughters, assisted by her father, a man over 70 years of age. The land was excellently worked and very clean. Although entirely self-trained this lady had evidently solved the problem of the cultivation of every plant she had taken in hand. Some idea of her work may be gleaned from the fact that she sends the flowers of an annual *Gypsophila* to market by the wagon-load.

Notes on Feeding Stuffs in December: *From the Animal Nutrition Institute, Cambridge University.*

THE last month has seen the greatest rise in prices of feeding stuffs of all kinds which has been recorded since these notes began in March, 1915. The rise affects practically every feeding stuff, and varies from 1½*d.* per unit to as much as 1*s.* 3½*d.* Prices all round have now reached an unprecedented level. Wet brewers' and distillers' grains are the only articles on the market which can be bought at a lower rate than 2*s.* per unit, and barley, oats, cotton cake and rice meal are in the neighbourhood of 4*s.* Under these conditions the strictest economy in feeding is more than ever necessary.

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate Prices per ton at the end of November. London.	Liverpool.	Hull.	Bristol.	Glasgow.	Leith.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soya Bean Cake	122·3	15 0 0	—	15 0 0	15 0 0	—	—
Decorticated Cotton Cake	126·3	—	15 0 0	—	15 15 0	15 5 0	16 0 0
American Linseed Cake	119·0	—	—	—	—	—	—
Indian Linseed Cake	123·1	—	—	—	—	15 10 0	16 0 0
Russian Linseed Cake	123·5	—	—	—	—	—	—
English Linseed Cake	120·1	16 0 0	16 10 0	15 10 0	16 0 0	16 0 0	16 10 0
Bombay Cotton Cake	65·3	12 5 0	12 0 0	12 15 0	11 15 0	—	12 10 0
Egyptian Cotton Cake	71·9	12 8 9	12 10 0	13 0 0	12 7 6	—	13 0 0
Coconut Cake	102·6	*14 5 0	—	—	14 15 0	—	—
Palm Kernel Cake	96·1	11 10 0	13 0 0	12 10 0	12 15 0	13 10 0	‖12 10 0
Palm Kernel Meal (extracted)	91·5	—	—	—	—	—	—
Ground-nut Cake	145·2	15 18 9	13 10 0	—	—	15 10 0	—
English Beans	99·5	15 11 7	17 10 0	14 18 11	14 14 9	—	—
Bean Meal	99·5	—	—	—	—	18 0 0	—
Chinese Beans	101·2	15 8 0	16 6 8	—	—	—	—
English Maple Peas	97·2	16 13 4	—	17 15 6	—	—	—
English Dun Peas	97·2	14 8 10	—	16 13 4	—	—	—
Calcutta White Peas	97·5	17 15 7	—	—	—	—	—
American Maize	93·8	15 1 0	14 16 10	15 5 8	—	} 14 10 0	15 5 0
Argentine Maize	94·2	14 18 8	14 18 8	15 8 0	15 5 8	}	
Maize Meal	86·5	16 0 0	15 17 6	15 12 6	15 10 0	15 5 0	16 0 0
Maize Gluten Feed	121·6	15 5 0	—	—	15 0 0	—	—
Maize Germ Meal	99·2	15 10 0	14 15 0	—	15 10 0	—	—
English Feeding Barley	83·0	16 16 0	—	17 7 2	—	—	—
English Oats	75·4	15 6 8	16 8 3	15 13 4	14 6 8	} 14 10 0	15 0 0
Argentine Oats	75·4	16 19 0	—	—	—	}	
Malt Culms	69·9	9 10 0	—	9 10 0	11 10 0	10 0 0	9 10 0
Brewers' Grains (dried)	84·5	11 5 0	—	9 10 0	12 0 0	11 0 0	10 10 0
Brewers' Grains (wet)	21·1	1 16 0	—	1 10 0	—	—	1 12 6
Distillery Mixed Grains (wet)	20·0	—	—	—	—	—	1 15 0
Distillers' Grains (English)	101·2	12 5 0	12 0 0	—	12 10 0	} 11 0 0	11 0 0
Distillers' Grains (French)	101·2	12 5 0	—	—	—	}	
Egyptian Rice Meal	78·7	15 0 0	—	—	—	} 14 0 0	—
Burmese Rice Meal	78·7	—	13 15 0	—	14 10 0	}	
Wheat Middlings (coarse)	94·8	†15 10 0	—	14 15 0	—	—	14 10 0
Wheat Sharps	90·5	†15 15 0	—	15 15 0	—	13 0 0	12 0 0
Wheat Pollards	96·7	—	—	—	—	—	—
Wheat Bran	77·5	†14 0 0	—	12 10 0	—	12 0 0	11 10 0
Wheat Bran (broad)	79·9	†15 0 0	—	13 10 0	—	12 5 0	12 10 0
Feeding Treacle	60·0	11 12 6	12 7 6	—	—	14 0 0	14 10 0
Linseed	153·5	26 0 0	‡28 0 0	26 15 9	27 6 6	¶32 0 0	¶33 0 0
Linseed Oil	250·0	51 0 0	§54 0 0	47 15 0	—	—	—
Egyptian Cotton Seed	108·6	18 10 0	—	—	—	—	—
Bombay Cotton Seed	99·6	—	—	—	—	—	—
Cotton Seed Oil	250·0	48 0 0	§55 0 0	48 0 0	—	—	—
Fish Meal	125·0	—	—	—	—	14 0 0	14 0 0
Locust Bean Meal	80·0	—	—	—	—	12 15 0	13 0 0

* Ceylon made £13 15s. per ton. † For December delivery "as early as grists allow."
‡ Cleaned. § In barrels. ‖ Carriage paid on 2-ton lots to any station. ¶ Crushed.

With all feeding stuffs advancing so rapidly in price, it is by no means an easy matter to suggest rations which are at once suitable and economical. The following suggestions, however, will, it is hoped, give good results at the cheapest rate possible under existing conditions:

Horses.—For horses at farm work it is impossible to suggest any reliable ration cheaper than those given in the notes for the last two months. These rations are reprinted here:—

I.—7 lb. Dried brewers' or distillers' grains.	II.—3 lb. Dried grains.
2 lb. Maize gluten feed.	4 lb. Maize.
1 lb. Linseed cake.	1 lb. Maize gluten feed.
	1 lb. Linseed cake.

These rations contain rather more protein and rather less carbohydrate than the ordinary ration of 12 lb. of oats, which they are designed to replace. This is most readily and cheaply corrected by giving each horse about a stone of pulped roots per day mixed with the chaff.

It would appear that people who keep horses in towns are still using oats exclusively for horse corn. With the present high prices and the urgent demand for oats for Army horses and for human food, this practice is both extravagant and unpatriotic.

The following mixture will be found suitable for nag horses or ponies at town work, and its use will decrease the consumption of oats to one quarter. At present London prices oats cost *1s. 11d.* per stone; the mixture would cost only *1s. 9¼d.* per stone:—

Distillers' or brewers' dried grains	1 part.
Maize gluten feed	1 ,,
Pollards or sharps..	1 ,,
Oats..	1 ,,

Such a mixture has about the same feeding value as oats, and may be used to replace oats weight for weight.

Cows.—There is nothing to add to the rations suggested in the last two months' notes.

Cattle-Feeding for Beef.—With the present scarcity and high prices of all kinds of concentrated foods, it is both unpatriotic and unprofitable to continue the production of overfat beef. Beef production under any circumstances is necessarily wasteful of fodder, in the sense that a given amount of fodder will produce far more human food if used for the production of milk, pork or bacon, or mutton than if fed to steers for the production of beef. It is possible, however, with fair economy of fodder, to produce steers which will yield from 51 to 54 per cent. of their

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8½	Linseed	3	4¾
Ground nut cake ..	2	2¼	English maple peas ..	3	5
Palm kernel cake ..	2	4¾	Egyptian cotton seed ..	3	5
Distillers' grains (English)	2	5¼	Egyptian cotton cake ..	3	5½
Distillers' grains (French)	2	5¼	Wheat sharps	3	5¾
Soya bean cake	2	5½	Wheat bran	3	7½
Maize gluten feed ..	2	6	Calcutta white peas ..	3	7¾
English linseed cake ..	2	8	Maize meal	3	8½
Brewers' grains (dried) ..	2	8	Bombay cotton cake ..	3	9
Malt culms	2	8¾	Wheat bran (broad) ..	3	9
Coconut cake	2	9¼	Egyptian rice meal ..	3	9¾
English dun peas ..	2	11¾	Cotton seed oil	3	10
Chinese beans	3	0½	Feeding treacle	3	10½
Maize germ meal ..	3	1½	English feeding barley ..	4	0½
English beans	3	1½	English oats	4	0¾
Argentine maize	3	2	Linseed oil	4	1
American maize	3	2½	Argentine oats	4	6
Wheat middlings ..	3	3¼			

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	1	10¼	Burmese rice meal ..	3	6
Distillers' grains (English)	2	4½	English beans	3	6¼
Decorticated cotton cake	2	4½	Linseed	3	7¾
Palm kernel cake ..	2	8½	Bombay cotton cake ..	3	8
English linseed cake ..	2	9	Maize meal	3	8
Maize germ meal ..	2	11¾	Feeding treacle	4	1½
Argentine maize	3	2	Linseed oil	4	3¾
American maize	3	2	English oats	4	4½
Chinese beans	3	2¾	Cotton seed oil	4	4¾
Egyptian cotton cake ..	3	5¾			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	5	English dun peas ..	3	5¼
Brewers' grains (dried) ..	2	3	Wheat sharps	3	5¾
Soya bean cake	2	5½	Linseed	3	6
English linseed cake ..	2	7	Maize meal	3	7½
Palm kernel cake ..	2	7¼	Egyptian cotton cake ..	3	7¼
Malt culms	2	8½	English maple peas ..	3	8
English beans	3	0	Linseed oil	3	9¾
Wheat middlings ..	3	1¼	Cotton seed oil	3	10
Wheat bran	3	2¾	Bombay cotton cake ..	3	10¾
Argentine maize	3	3¼	English oats	4	2
American maize	3	3¼	English feeding barley ..	4	2¼
Wheat bran (broad) ..	3	4½			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Soya bean cake	2	5½	Maize germ meal ..	3	1½
Maize gluten feed ..	2	5½	Argentine maize ..	3	3
Distillers' grains (English)	2	5¾	Malt culms	3	3½
Decorticated cotton cake	2	6	Egyptian cotton cake ..	3	5¼
Palm kernel cake	2	7¾	Linseed	3	6¾
English linseed cake ..	2	8	Maize meal	3	7
Brewers' grains (dried) ..	2	10	Bombay cotton cake ..	3	7¼
Coconut cake	2	10½	Burmese rice meal ..	3	8¼
English beans	2	11½	English oats	3	9½

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

LONDON, LIVERPOOL, HULL AND BRISTOL.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	6¾	Wheat bran	3	5
Ground nut cake ..	2	0¼	Egyptian cotton seed ..	3	5
Distillers' grains (English)	2	5¼	Wheat sharps	3	5¾
Distillers' grains (French)	2	5¼	Egyptian cotton cake ..	3	6
Decorticated cotton cake	2	5¼	Linseed	3	6¼
Soya bean cake	2	5½	English maple peas ..	3	6½
Maize gluten feed ..	2	5¾	Wheat bran (broad) ..	3	6¾
Brewers' grains (dried) ..	2	7	Burmese rice meal ..	3	7
Palm kernel cake ..	2	7	Maize meal	3	7¾
English linseed cake ..	2	8	Calcutta white peas ..	3	7¾
Coconut cake	2	9¾	Bombay cotton cake ..	3	8¾
Malt culms	2	11	Egyptian rice meal ..	3	9¾
Maize germ meal	3	1¼	Feeding treacle	4	0
Chinese beans	3	1½	Cotton seed oil	4	0½
English beans	3	1¾	Linseed oil	4	0¾
Wheat middlings ..	3	2¼	English oats	4	1
English dun peas ..	3	2¼	English feeding barley ..	4	1¼
Argentine maize	3	2½	Argentine oats	4	6
American maize	3	2½			

TABLE VII.

GLASGOW. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	2	1½	Wheat bran (broad) ..	3	0¾
Distillers' grains (dried) ..	2	2¼	Wheat bran	3	1¼
Fish meal	2	3	Maize	3	1¼
Decorticated cotton cake	2	5	Locust bean meal ..	3	2¼
Indian linseed cak ..	2	6¼	Maize meal	3	6¼
Brewers' grains (dried) ..	2	7¼	Rice meal	3	6¾
English linseed cake ..	2	8	Bean meal	3	7¼
Palm kernel cake ..	2	9¾	Oats	3	10
Malt culms	2	10¼	Linseed	4	2
Wheat sharps	2	[illegible]	Feeding treacle	4	8

TABLE VIII.

LEITH. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	6½	Wheat bran	2	11½
Distillers' grains (wet) ..	1	9	Wheat middlings ..	3	0¾
Distillers' grains (dried) ..	2	2¼	Wheat bran (broad) ..	3	1½
Fish meal	2	3	Locust bean meal ..	3	3
Brewers' grains (dried) ..	2	5¾	Maize	3	3
Decorticated cotton cake	2	6½	Egyptian cotton cake ..	3	7½
Indian linseed cake ..	2	7¼	Maize meal	3	8½
Palm kernel cake ..	2	7¼	Bombay cotton cake ..	3	10
Wheat sharps	2	8	Oats	3	11¾
Malt culms	2	8¾	Linseed	4	3¾
English linseed cake ..	2	9	Feeding treacle	4	10

TABLE IX.

AVERAGE PRICES PER FOOD UNIT.
GLASGOW AND LEITH.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	6½	Wheat middlings ..	3	0¾
Distillers' grains (wet) ..	1	9	Wheat bran (broad) ..	3	1¼
Ground nut cake ..	2	1½	Maize	3	2
Distillers' grains (dried) ..	2	2¼	Locust bean meal ..	3	2½
Fish meal	2	3	Rice meal	3	6¾
Decorticated cotton cake	2	5¾	Egyptian cotton cake ..	3	7½
Brewers' grains (dried) ..	2	6½	Bean meal	3	7½
Indian linseed cake ..	2	6¾	Maize meal	3	7½
English linseed cake ..	2	8½	Bombay cotton cake ..	3	10
Palm kernel cake ..	2	8½	Oats	3	11
Wheat sharps	2	9¼	Linseed	4	3
Malt culms	2	9½	Feeding treacle	4	9
Wheat bran	3	0½			

live weight in the form of carcass by the use of the rations suggested below. Such steers have been produced repeatedly on the University Farm. They are sought after by the local butchers, and the meat gives every satisfaction to the consumers.

The rations suggested for 9 cwt. steers are:—

I.—2 bush. or about 90 lb. roots.
10 lb. Chaff.
1½ lb. Ground nut cake.
1½ lb. Dried brewers' or distillers' grains.

II.—Roots and chaff as in I.
1½ lb. Linseed cake.
1½ lb. Palm kernel cake.

III.—Roots and chaff as in I.
1½ lb. Maize gluten feed.
1½ lb. Linseed cake.

These rations will in four or five months produce steers which will kill at 51 to 54 per cent. carcass weight.

To make prime steers killing at 58 per cent. carcass weight or over a very great deal more concentrated food is required

The resulting beef, with its large proportion of kidney suet and waste fat must be regarded as a luxury, and cannot be produced either at a personal profit or to the national good at the present time when the country needs quantity of food rather than quality. There is no doubt that a given amount of fodder will produce more human food if used as directed above than if fed to a smaller number of prime steers, especially if the surplus of the roots is fed to pigs as suggested below.

Young Stock.—It is not feasible to suggest rations cheaper than those given in the notes for the last two months. At the present very high price of bran, however, it may be wise to use bran

TABLE X.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv, per 100 lb.	Linseed cake equiv, per 100 lb.
Foots Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	*1 : 1·2*	*34·0*	*8·5*	*20·0*	*71·0*	*93*
Linseed cake Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains, English " " French	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm kernel cake	1 : 4·5	14·1	6·1	48·9	76·7	101
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Fish meal	1 : 0·1	54·0	2·0	—	56·0	74
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Palm-nut meal (extracted)	1 : 3·4	15·6	1·9	48·7	66·1	87
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·5	73·1	96
Wheat sharps	1 : 5·1	11·6	5·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·7	11·3	3·0	45·4	48·1	63
Locust bean meal ..	1 : 22·1	4·0	0·7	69·2	71·4	94

only for stock under five months old. After this age it may be slowly replaced by palm kernel cake at the rate of 2 lb. of cake in place of 3 lb. of bran.

Ewes.—Ewes due to lamb in January will now require some kind of concentrated food: ¼ lb. bran per head per day is a safe ration, but at present prices some breeders may venture to replace it by palm kernel cake or by linseed cake and dried grains. Palm kernel cake should be used at the rate of about 2 lb. of cake in place of 3 lb. of bran, and linseed cake and grains at the rate of 3 lb. of the mixture in place of 4 lb. of bran. The writers have no personal experience of these foods for lambing ewes. Anyone who tries them should keep his ewes under close observation.

Pigs.—It is impossible to recommend any cheap ration of the ordinary kind, since all kinds of starchy meals are very expensive. The cheapest way to feed pigs at the present time is to use a mixture of pulped roots and either finely-ground palm kernel cake or maize gluten feed. In using such a mixture 1 stone of the meal or the gluten feed should be mixed with 3 bushels of pulped roots. The resulting mixture will possess almost exactly the same feeding value as 2 stones of barley meal, which it will be found to replace very successfully and economically. Since pigs convert a much greater proportion of their fodder into human food than do any other stock, the adoption of this practice will yield far more food for the nation than would be obtained by feeding to bullocks and sheep all the roots not required for milk production.

Notes on Manures in December:

From the Rothamsted Experimental Station.

Organic Manures.—This is the proper season for dealing with the organic manures that are to be used; they should go on earlier than the others, and must therefore be prepared for now. Of all the organic manures, farmyard manure is by far the most popular. The home-made product was discussed last month. Many farmers are able to supplement this by purchasing stable manure from London, but as this differs somewhat from the home-made material it requires rather different treatment. It was pointed out last month that farmyard manure suffers loss in the clamp, however well made, and if it can be worked into the land so much the better, excepting only in wet districts, where a good clamp has the advantage. Purchased town manure is an important exception to this rule. *London dung* is almost always better for being clamped. Before it reaches the farm it is rather

freely contaminated with weed seeds, which may give a good deal of trouble if the manure is spread at once and ploughed in; if, however, it is clamped and left till spring the weed seeds are largely killed.

Among nursery gardeners, growers under glass, and some potato farmers it has been the custom to "turn" the town stable manure in order to "sweeten" it, the impression being that it contains some poison, which can only be got rid of in this way. One need not pretend to say what is present in London stable dung, but there is no evidence that it needs turning before it can be used. It is certainly liable to cause injury to delicate foliage if it is applied as a top-dressing in its fresh state, but for digging into borders, making up borders, or use for potatoes or any other crop, there is no advantage in turning it, whilst there is the considerable disadvantage that much ammonia is thereby lost.

In many districts supplies of *Army stable manure* are available. The manure is very good, and deteriorates so little in the dumps, that it retains most of its value even after eight months' storage; it can be strongly recommended to farmers who are in a position to get it. Inquiries should be addressed to the Officer Commanding, Army Service Corps of the nearest camp. In many places it is offered at 1*s*. per load of about 15 to 18 cwt.; elsewhere it is 2*s*. 6*d*. per ton load—at the dump in each case. Its composition is very similar to London manure; it is not as good as bullock manure made in a covered yard, because most of the urine, which contains the chief part of the fertilising material, fails to be collected. It is, however, worth at least 5*s*. or 6*s*. per ton on the farm, and if a farmer can get it on his land at this price he should certainly do so.

It may happen that neither the home-made supplies of farmyard manure nor the purchased supplies of town or Army manure fully satisfy all requirements. Other organic manures may then be necessary.

Fish guano is very satisfactory. A good quotation is recorded (*see Table*) from Hull. Fish guano gives admirable results with wheat, oats and roots; in ordinary times it can hardly be used for cereals, but at present prices it probably can, especially where no farmyard manure has been available for some time. It must be worked in quickly, otherwise the birds may take it.

Castor meal is another useful organic manure. It has about one-half the fertilising value of fish guano, and is worth somewhere about one-half the price—certainly no more. In addition

to 4 or 5 per cent. of nitrogen, it also contains about 3 or 4 per cent. of phosphate, and 1 to 1½ per cent. of potash. The amount of potash thus introduced into the soil, however, is too small to be worth paying for, and far less than would be given in a dressing of farmyard manure, London stable manure, or Army manure.

Shoddy is another material that deserves attention where it can be got cheaply. It should only be purchased on the basis of its analysis, and it may be put under present conditions at about 7*s.* per unit—*i.e.*, if the sample contains 7 per cent. of nitrogen a reasonable price would be about 49*s.* per ton at the mill—carriage extra. Shoddy can be used on any crop, and gives a good return at once; thus, at Rothamsted, the following results were obtained by the use of 10 cwt. per acre:—

	Mangolds, 1911. tons.	Wheat, 1912. Bush. of Grain.	Swedes, 1913. tons.	Barley, 1914. Total Produce. lb.	Average of all Crops and Experiments, 1904–15.
10 cwt. shoddy	14·7	28·4	10·7	4,516	140
Unmanured ..	11·7	24·0	7·9	2,805	100
Increase per cent.	26	18	35	61	40

On an average, 10 cwt. of shoddy per acre has given a 40 per cent. increase in crop, this being as much as was given by 16 tons of ordinary farmyard manure per acre.

Shoddy can go on in winter, or at any time up till March. It must, however, be applied before the last ploughing, as it has to be worked into the land. It has never been used as a top dressing at Rothamsted.*

In addition to the fact that organic manures supply valuable organic matter essential for the proper cultivation of the soil, another great advantage is that they enable the farmer to spread out the season for applying manures. Organic manures can go on earlier than artificials; one can apply them perfectly well in December or January, before one would ordinarily use sulphate of ammonia, and much sooner than nitrate of soda would be possible. With the prospect of short labour this is no small consideration.

Potassic Fertilisers.—Considerable interest has been aroused by the announcement recently made in *The Times* by Sir Thomas Mackenzie that extensive deposits of potash occur in South Island, New Zealand. The deposit is in the form of a mica schist containing about 3 per cent. of pure potash (K_2O); it is soft and very easily disintegrated to a fine powder. It is said

* Further information on shoddy will be found in this *Journal* for March, 1915, p. 1087.

to be extraordinarily abundant and one of the easiest minerals to mine.

Unfortunately there is no evidence that these mica schist deposits are of agricultural value. For some years experiments have been made with them at Woburn—not with this particular one, but with the other potash minerals, felspar, phonolit, granite, etc., and none of them possessed much manurial value. The question has also been studied by the able Russian investigator Prianishnikov, who also obtained negative results with phonolit and with another mineral, glauconite. He was, however, successful in finding two potash minerals of high fertilising value—biotite and nephelin—but unfortunately these do not seem to be of very extensive occurrence. Until the technical chemist has discovered some way of dealing with the extensive New Zealand deposits, to make the potash more soluble, they are not very promising materials for the agriculturist.

The most promising of all sources of potash is seaweed, of which we have an abundance round our coasts. One ton of the fresh weed contains as much potash as 1½ cwt. of kainit. One of the most urgent needs of the time is to develop this source of potash.

A smaller, but nevertheless important, source of potash available on every farm is afforded by ashes from bonfires. The ashes of hedge trimmings contain up to 10 per cent. of potash, nearly the same amount as in kainit; by keeping the hedges very closely trimmed, and burning the trimmings, one therefore obtains the double benefit of clean hedges and extra supplies of ash. Brushwood, useless fallen timber, and other waste material from woods and coppices, yield ash containing 5 to 8 per cent. of potash and 20 to 40 per cent. of lime; this sort of material may well be burnt because it only harbours pests. Burnt hay-ricks, and waste cavings, dust, etc., obtained during threshing, also yield an ash containing up to 10 per cent. of potash. All these should be carefully collected. The potash is in a highly available form; indeed, it is so soluble that a single night's rain may wash half of it away. The ash, therefore, has to be collected as speedily as possible, or if it is too hot to be got in before rain comes on it must be sheltered in some way. The ash tends to absorb water from the air, so that it does not keep well, and it is difficult to spread because of its lightness. Both these difficulties, however, can be overcome by mixing it with superphosphate.

A third method is to draw on the reserves of the soil. This, of course, cannot be practised indefinitely, but where high farming

has been the rule the amount of potash supplied in the imported fertilisers, stable manure, or feeding-stuffs may well have been greater than the amount removed. There has, therefore, been some accumulation in the soil, which can now be treated as a reserve, and drawn upon for the needs of the crop. There are two ways of doing this:—(1) Salt or sulphate of soda may be applied; or (2) the land may be limed.

(1) On any land known to benefit by kainit it is advisable to try dressings of salt. The most suitable crops are mangolds, cereals, and grass land.

Mangolds gave the following results at Woburn*:—

	Un-manured	No salt.	1 cwt. salt.	2 cwt. salt.	4 cwt. salt.	6 cwt. salt.
Mean of 4 varieties in tons per acre	27·0	30·9	30·6	34·3	34·6	36·3

All plots, except the unmanured, received 1 cwt. nitrate of soda per acre.

At the Harper Adams College† the yields in tons per acre for the three seasons 1913-15 were:—

No salt.	5 cwt. salt after sowing.	10 cwt. salt after sowing.
27¼	35¼	36

All plots received farmyard manure, and, in addition, 2 cwt. of dissolved bones, ½ cwt. of superphosphate, and ½ cwt. of sulphate of ammonia per acre.

In the Cockle Park trials (*Cockle Park Bull.* No. 16, 1911) 2 cwt. of salt increased the yield of mangolds by nearly 4 tons per acre on an average of 5 years. Good results have also been obtained elsewhere.

Cereals, especially wheat, used to receive salt in the old days, and might well do so now on thin or chalky soil. Only a few experiments have been made on the subject: In Yorkshire, salt increased the yield of barley, both in the dry season of 1901 and the wet season of 1903, but the results of later experiments were not conclusive.

There is considerable evidence that sulphate of soda liberates potash from the soil. It has been used for many years at Rothamsted, often with good effect and never with bad. It must, however, be free from acid. Some samples contain a fair quantity of potash; one recently analysed at Rothamsted had as much as 23 per cent., equivalent to 47·4 per cent. of sulphate of potash. This, however, is unusually good.

(2) For leguminous crops it is probably safer to use *lime* than salt; it may, however, be better to treat them with basic slag.

* *Jour. Roy. Agri. Soc.*, 1908, pp. 69 and 355.
† The experiment is described in Harper Adams Report for 1909, p. 14.

	England and Wales.										Scotland.	
	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.	Glasgow.	Leith.
Nitrogen from :	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sulphate of Ammonia pure.. 95 %	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	—	15 6
Sulphate of Ammonia pure.. 93 %	—	—	—	—	—	—	—	—	—	—	—	—
Calcium Cyanamide (Nitrolim)	17 4	—	—	—	—	—	—	—	—	18 7	—	—
Nitrate of Soda pure .. 95 %	—	—	23 8½	—	—	24 0	24 8	—	23 6½	23 2½	—	22 7
Nitrate of Soda pure .. 90 %	25 7½	25 4	24 0	—	—	—	—	—	24 4	24 8	—	—
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—	—	—
Castor Meal..	—	23 7	21 7½	—	—	—	—	—	—	—	—	—
Allowed for Insol. Phos.	—	*2 0*	*2 0*	—	—	—	—	—	—	—	—	—
Allowed for Potash ..	—	*15 0*	*15 0*	—	—	—	—	—	—	—	—	—
Soluble Phosphates from :												
Superphosphate 35 %	3 4½	2 10	3 4½	3 10½	3 7½	3 7	3 6	3 5	—	—	3 7½	—
" 33 %	3 4	2 11	3 3	—	—	3 6½	3 6	3 5	—	—	—	—
" 30 %	3 4	3 0½	3 4	3 11	3 8	3 7	3 6	3 5	—	—	3 8	—
" 26 %	3 8	3 3	3 8	4 4	4 0½	3 11½	3 10	3 9	—	—	3 10½	—
Dissolved Bones.. ..	5 0½	4 7	4 10½	—	5 0½	5 3	5 3	5 1	5 3	5 2	—	—
Allowed for Nitrogen	*20 3½*	*18 5½*	*19 6*	—	*20 1½*	*21 1*	*21 0½*	*20 5½*	*21 0½*	*20 8*	—	—
Allowed for Insol. Phos.	*2 9½*	*2 6½*	*2 8*	—	*2 9½*	*2 11*	*2 11*	*2 10*	*2 10½*	*2 10½*	—	—
Insoluble Phosphates (Citric Soluble) from :												
Basic Slag	2 9½	2 9½	2 6	—	—	—	—	—	—	3 6	3 0½	2 9½
Insoluble Phosphates from :												
Basic Slag	—	—	1 11½	1 10½	—	2 0	—	—	—	2 8½	—	—
Bone Meal	2 6	2 6½	2 5½	2 5	2 7½	2 9	2 9	2 4½	2 8½	2 6	—	3 0½
Allowed for Nitrogen	*17 11½*	*18 5½*	*17 8*	*17 6½*	*18 11*	*19 10*	*19 9½*	*17 1*	*19 9*	*18 1½*	—	*15 6*
Steamed Bone Flour..	2 6	2 7	2 8½	2 3½	—	2 4½	—	2 2	2 5½	—	—	—
Allowed for Nitrogen	*18 1*	*18 9*	*19 7½*	*16 5½*	—	*17 2½*	—	*15 6½*	*17 10*	—	—	—
Fish Guano..	—	3 3½	2 9	—	—	—	—	—	—	—	—	—

It is often considered that *gypsum* liberates potash from the soil, but there is no definite evidence to this effect. The Broadbalk plot results are rather against this view, the crop manured with ammonium salts and superphosphate (which contains a good deal of gypsum) being no richer in potash than that manured with ammonium salts only, and considerably poorer than that manured with ammonium salts, superphosphate, and sodium salts. Gypsum, however, has a valuable effect somewhat similar to the effect of potash; it helps to counteract adverse influences on the crop, and may, therefore, in bad seasons prove very helpful. Gypsum is an important constituent of superphosphate, and would hardly be necessary where this is used; it might, however, prove useful where no superphosphate is applied. Where supplies are available it might be well to inquire from the County Organiser whether, and to what extent, the material is likely to be of manurial value.

Unit Prices of Artificial Manures in December.—The statement on p. 896 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for December, 1916.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating, and rebagging the ingredients, bags, and loss of weight.

The Encouragement of Cheese Production.

THE following notes show the action which has been taken in various counties with the view of increasing the production of cheese; these notes are given in continuation of those which appeared in the *Journal* for November, 1916, p. 767:—

Staffordshire.—This is one of the largest milk-producing counties which, owing to its proximity to several large consuming centres, for the most part adopts the whole milk trade. Because of this the opportunity to increase cheese-making is limited. The Education Authority decided, however, to discontinue instruction in butter-making and directed their staff teacher of dairying to devote her

attention to cheese-making, and as a result the Authority have recently found it desirable to appoint a second instructress to conduct a second itinerant school.

Cheshire.—In this county two teachers have been appointed to carry on a peripatetic programme of instruction. They were rather late in starting, but so far as it has gone the work promises to be successful.

Derbyshire.—The Authority in this case had some doubt as to the scope for increasing cheese-making, but eventually an instructress was appointed for a short period to give demonstrations in cheese-making for the small holders. The justification for her appointment cannot be better illustrated than by stating that the demand for her services has twice obliged the Committee to extend the period of her engagement.

Cumberland and Westmorland.—Work among the small holders has been very successful. The Authority started with one travelling school in the early part of the year, and they have since added a second in order to cope with the demand. It is reported that practically all those who have attended the classes have started to make cheese.

Durham.—Instruction in small cheese-making has been given for some years. The Education Authority have now opened a second school for the purpose of tapping new districts. The work is meeting with success.

Lincolnshire (Lindsey).—The work of instruction in cheese-making for small holders, started last season, is being continued with increased vigour, and it is reported that most of those who have been instructed are now making cheese on their holdings.

Hampshire.—Migratory instruction in cheese-making was started in the spring, and the Director of Education reports that considerable progress has been made among small holders, and that the people have quite taken to cheese-making.

Welsh Counties.—A travelling cheese school has recently been started in Carnarvonshire. It is understood that the staff instructresses in dairying in eight other Welsh counties are now largely devoting their energies to teaching cheese-making in lieu of butter-making.

** In the article in the *Journal* for November, 1916, p. 767, the word "where" was inadvertently omitted in the second line of the second paragraph. The sentence should run: "In the first place, there is, in milk-selling districts, in the flush season, considerable wastage of surplus milk *where* no milk-factories for cheese-making from surplus milk exist."

Whale Guano.

THE Board desire to direct the attention of farmers to the fact that there is available in Great Britain a fair quantity of Whale Guano, for which there does not appear to be a very good demand. The average content of nitrogen and phosphoric acid in three samples analysed in the first half of this year is stated to be about as follows:—Nitrogen, 8 per cent.; phosphoric acid, 10·6 per cent. (=23 per cent. of tribasic phosphate of lime). Oil, however, which has no manurial value, and may even in some degree retard the action of the other ingredients mentioned, was present to the extent of 14 per cent. The subject will receive further attention in a subsequent issue of this *Journal*, but it may here be suggested that if whale guano of the quality above mentioned can be obtained at a fair price compared with other artificial manures

it may usefully be tried for such crops as potatoes, cabbages, turnips, mangolds, fruit trees and bushes, particularly on ligh' soils.

OFFICIAL NOTICES AND CIRCULARS.

THE following Notice to Farmers, dealing with Soldier Labour, was issued on 20th November :—

Soldier Labour.

1. The President of the Board of Agriculture and Fisheries desires to remind farmers that the arrangements remain in force for the employment of soldiers on ordinary agricultural work.

2. A farmer living in the neighbourhood of a military station who desires to employ soldiers **at short notice for a period not exceeding six working days** may apply **direct** to the Commanding Officer of the military station for the men he requires.

3. **Convalescent Soldiers** at Infantry Depots, Command Depots, and Convalescent Hospitals may be employed temporarily on agricultural work within easy reach of where they are stationed. If such men are required at short notice the farmer may apply direct to the Officer Commanding the Depot or Hospital.

4. **In all other cases a farmer who desires to employ soldiers or convalescent soldiers on his land must apply to the Local Employment Exchange of the Board of Trade.**

5. Information and advice on the subject of soldier labour can be obtained from the Secretaries of the County War Agricultural Committees as well as from the local Employment Exchange.

THE following Circular Letter, dated 20th November, 1916, has been addressed by the Board to the Secretaries of the War Agricultural Committees :—

Release of Soldiers for Agricultural Work.

Sir,—I am directed by the President of the Board of Agriculture and Fisheries to advert to the Board's Circular Letter of the 5th June last, A.270.C, enclosing copies of a Memorandum issued by the Army Council, stating the conditions on which soldiers may be released for agricultural work, and I am to say that, from communications which have been received in this Office, it would appear that many farmers are not fully aware of the arrangements made for the release of soldiers for agricultural work, other than for the harvest.

2. *Full details of the arrangements are set out in the Memorandum* referred to in the foregoing paragraph, but in order that there should be no misunderstanding, I am to enclose a copy of a poster* which your Committee may think it useful to issue in this connection.

3. Additional copies of the poster will be supplied from this Office on application.

I am, etc.,
SYDNEY OLIVIER, *Secretary.*

THE following Circular Letter (dated 9th November, 1916, has been sent to the Secretaries of the War Agricultural Committees in England and Wales :—

Substitution of Agricultural Labour.

SIR,—(1) I am directed by the President of the Board of Agriculture and Fisheries to invite the careful attention of your Committee, and through them, that of the farmers in your county, to the War Office scheme of substitution of agricultural labour.

(2) As has already been announced in the Board's Circular Letter of the 5th ultimo, the Army Council have agreed that, subject to certain conditions, no man now engaged in general farming, will be called to the Colours before 1st January, unless a substitute is provided ; and no man engaged in milk production before 31st March, unless a substitute is provided.

(3) The general scheme of substitution is as follows :—Officers Commanding Units at home will prepare lists of men, who before enlistment were engaged in agriculture and who can now be transferred to the Army Reserve and returned to their agricultural occupation, in order to release younger men who are fit for general service in the field. The lists will be available for the use of the agricultural representatives referred to in paragraphs 5 and 6 of this letter.

(4) The Officers Commanding will appoint a Military Substitution Officer for each area, which will be as a rule the county, and it is desired that there should be a representative of agriculture to confer with this officer in dealing with substitution cases.

(5) It is proposed that the Board's representative before the Appeal Tribunal should, wherever possible, be the Agricultural Representative for dealing with substitution cases. If it is not possible for this gentleman to undertake the duty, it will be necessary for the Chairman of the War Agricultural Committee in consultation, if necessary, with the Committee, to nominate another person or persons for the purpose.

(6) A list of the recruiting areas is enclosed,† and the agricultural representative should take immediate steps to get into communication with the Commanding Officer of the area of which the county forms part, for the purpose of ascertaining whether one or more substitution officers will be appointed in the county, and the areas for which they will act. When this information has been obtained, it should be communicated to the Chairman of the War Agricultural Committee, who should take the necessary steps to appoint such additional agricultural representatives as may be necessary in your county.

(7) The method of arrangement for substitution will be as follows :—The employer will be approached by the Substitution Officer with a view to ascertaining whether he is at present employing any man fit for general service. If he is a substitute will be offered, selected from men who, before enlistment, were employed in agriculture, and, if possible, a man who was employed with that employer or in the same parish.

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† Not printed.

(8) If the proposed substitution is agreed upon, the War Office will take steps to place the substitute on the farm.

(9) If the proposed substitution is not agreed to by the employer the Substitution Officer will consult with the agricultural representative with regard to the suitability of the substitute proposed, and if it is not possible to arrange amicably for the substitution to be effected on account of the farmer being unwilling, on grounds which appear to the Substitution Officer and the agricultural representative to be unreasonable, steps will be taken to cause the certificate of exemption, held by the man fit for general service still employed by him, to be reviewed, and the military representative will bring to the notice of the Tribunal the fact that a substitute has been offered and refused.

(10) If a man who has been transferred to the Reserve for the purpose of working at agriculture should leave the occupation to which he has been assigned, he will, as a rule, be called up for service with the Colours again, and will not be allowed to take up other employment without the consent of the military authorities.

(11) Area Commanders and agricultural representatives in arranging all cases of substitution are to satisfy themselves that the wages to be paid to the substitutes are fair and in accordance with the rates at present ruling in the district.

(12) All differences arising between farmers and substitutes will be dealt with by the Area Commander, in consultation, if necessary, with the agricultural representative, and if a substitute leaves a farmer who has treated him well, another substitute will, under present conditions, be provided if the farmer applies for one.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Women in Agriculture.

THE following Notice was issued on 24th November:—The President of the Board of Agriculture desires to call public attention to the urgent need that exists for the assistance of women, not already connected with the agricultural industry, in the work that is required for food production on the land, and to replace agricultural labourers who have been called up for military service. Hundreds of women have already rendered valuable service in maintaining the home-grown food supply, but thousands are now needed to meet the national emergency. Educated women are especially invited to offer their services, and short courses of training can be provided for them. Application should be made to the secretaries of the Women's War Agricultural Committees in the various counties, or to the Women's National Land Service Corps, 50, Upper Baker-Street, London, N.W.

Prohibition of Use of Wheat in Manufacture of Beer, etc.

IT has been reported to the Board of Trade that, in consequence of the scarcity and the high price of barley, purchases of wheat have recently been made by brewers for use in their business. The Board of Trade have accordingly made an Order, the effect of which is to prohibit the use of wheat in the manufacture of beer and similar liquors. The Order came into force on 27th November.

The use of any grain for the production of spirits, without the authorisation of the Ministry of Munitions, was prohibited by an Order dated 10th May last. (*Board of Trade Journal*, 30th November, 1916.)

Census of Hides.

In pursuance of the powers conferred upon them by the Defence of the Realm (Consolidation) Act, 1914 (as amended by the Defence of the Realm (Amendment) Act, 1915, and the Defence of the Realm (Amendment) No. 2 Act, 1915), and the Regulations made thereunder, and every other power enabling them in that behalf, the Army Council have required all persons engaged in the sale, distribution, storage or shipment of calf, ox, cow, bull, buffalo and horse hides, or engaged in the manufacture of leather from such hides, to furnish to the Director of Army Contracts, such particulars of their stocks, purchases and sales of, and transactions in, such hides as may be required on his behalf. (*Board of Trade Journal*, 16th November, 1916.)

Purchase and Sale of Wool.

In pursuance of the powers conferred upon them by the Defence of the Realm (Consolidation) Regulations, 1914, the Army Council have issued an Order, dated 14th November, to the following effect :—

No person shall sell raw wool grown or to be grown on sheep in Great Britain and the Isle of Man during the season of 1916, including fleece wool and skin wool, but not including daggings, locks, brokes and fallen wool, otherwise than to persons authorised by licence, appointment, or general or special permit granted by or on behalf of the Director of Army Contracts, or at prices other than those set out in the Schedule to the Order, or at such other prices as in any particular case may be allowed by or on behalf of the Director of Army Contracts.

No person shall in pursuance of any contracts entered into at any time prior to 8th June, 1916, make delivery of or payment for raw wool grown or to be grown in Great Britain and the Isle of Man, as aforesaid, during the season of 1916. (*Board of Trade Journal*, 16th November, 1916.)

Maximum Prices for Hay and Oat or Wheat Straw.

In pursuance of the powers conferred upon them by the Defence of the Realm (Consolidation) Regulations, 1914–1916, the Army Council have ordered that on any sale of hay and oat or wheat straw in Great Britain, Ireland or the Isle of Man, the price shall not exceed such prices as are set out in the Schedule to the Order.

The Schedule may be consulted by British firms interested at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. (*Board of Trade Journal*, 9th November, 1916.)

Food Supply Orders.

The Board of Trade have made two Orders under Regulation 2F. of the Defence of the Realm (Consolidation) Regulations : (i.) relative to the price of milk, and (ii.) relative to the manufacture of flour and bread. The following is a summary of the main provisions of the Orders :—

Price of Milk.—The Price of Milk Order, 1916, fixes for Great Britain maximum prices for milk both by wholesale and by retail. These prices have been fixed at figures which should be sufficient to maintain the production of milk. The general effect of the Order is to impose a double limit on prices :—(1) The price may not be raised above that paid at 15th November, 1916; (2) The price may not exceed by more than a specified amount the price in the corresponding month

before the War. This amount in the case of retail milk is 2*d*. per quart. The specified amounts that may be added to the pre-war price in respect of wholesale milk are 6½*d*. per imperial gallon delivered on the premises of the buyer where the conditions of sale include an obligation to deliver not less than a specified minimum, and 5½*d*. per imperial gallon in other cases.

The Order does not deal with condensed milk, dried milk, or milk preparations. As regards "accommodation milk" and milk sold by retail for consumption on the premises, the Order provides that the price shall not be raised above that paid at 15th November, 1916, but the limit of increase above the pre-war price does not apply.

The Order came into force on 27th November, but where contracts made before 15th November for the supply of milk by wholesale provide for a higher price, this higher price may continue to be charged under the contract till 31st December. Other exemptions are allowed in special circumstances only.

Milling of Flour.—The Milling Order, 1916, fixes for the United Kingdom the percentages of flour that must be extracted from wheat of various qualities according to the following schedule :—

	Per cent.		Per cent.
English	76	No. 1 Northern Manitoba Old Crop.	76
Choice Bombay	78	No. 2 ,, ,,	75
Australian	78	No. 3 ,, ,,	73
Blue Stem	76	Choice White Karachi ..	75
Walla Walla	75	Soft Red Karachi	75
No. 2 Red Western ..	76	Rosafe 62 lb.	73
No. 2 Red Winter	74	Baril 61½ lb.	74
No. 2 New Hard Winter (1916)	76	Barletta/Russo. 61½ lb. ..	74
No. 1 Northern Duluth ..	75		

The Order came into force, as regards milling, on 27th November; that is to say, on and after that date no wheat may be milled except in accordance with this schedule. On and after 1st January, only flour milled in accordance with the schedule may be used for making bread or any other article of food.*

A subsequent Order will be issued requiring periodical returns of stocks of wheat received and of flour and offals milled and of all stocks in hand on the date of the Milling Order coming into operation, *i.e.*, 27th November.

Communications as to these two Orders should be addressed for the present to the Board of Trade (Food Supplies), Gwydyr House, Whitehall, London, S.W. (*Board of Trade Journal*, 23rd November, 1916.)

Census of Agricultural Labour.

As all agriculturists are aware, the War Office have obtained, by means of a Census Form, particulars of the labour at present employed on farms, together with information as to the cropping and stock, and of the men formerly employed who have joined the Army since the outbreak of War.

The forms were left on all occupiers of five acres of land and upwards, and were distributed and collected by the police. The forms were filled up in duplicate, one copy being sent by the police direct to the War Office, where the information is being tabulated and summarised. The other copy was sent to the Officer Commanding the recruiting area in which the farm is situated.

* This provision has since been somewhat relaxed as regards bread made from *imported* flour.

These latter forms are being scrutinised by committees set up in ıch area, and a report is being attached to each form stating whether, aving regard to the scale set out in the Local Government Board ircular R.92 of the 22nd June last (see *Journal* for October, 1916, . 700), together with a knowledge of local conditions, it is considered hat the labour available is (*a*) sufficient, (*b*) excessive, (*c*) deficient.

This report will take the form of a stamp slip attached or other onvenient method, but, in cases where the labour on the holding is onsidered either excessive or deficient, the particular deficiency or xcess will be stated, *e.g.*, ploughman, carter, general labourer.

Both the Board of Agriculture and Fisheries and the War Office ttached great importance to agriculturists being represented by somene in whom they had confidence when the forms were being crutinised, and it has been arranged that the Board's representatives efore the Appeal Tribunal, who have been appointed the agricultural epresentatives for the purpose of the War Office Substitution Scheme, hould make the necessary arrangements, in conjunction with the Var Agricultural Committees, for the appointment of suitable persons o represent agriculturists on the committees who will undertake the crutiny.

Produce of Potato and Root Crops.

PRELIMINARY STATEMENT showing the estimated total produce and ield per acre of the potato and root crops in England and Wales in the year 1916, with comparisons for 1915, and the average yield per acre of the ten years 1906–1915.

—	Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1906–1915.
		1916.	1915.	**1916.**	1915.	**1916.**	1915.	
		Tons.	Tons.	Acres.	Acres.	Tons.	Tons.	Tons
ENGLAND AND WALES.	Potatoes ..	**2,503,886**	2,858,093	**427,948**	463,399	**5·85**	6·17	6·18
	Turnips and Swedes ..	**12,985,388**	11,807,257	**932,366**	928,949	**13·93**	12·71	13·12
	Mangolds	**7,337,678**	*7,834,080*	**376,950**	*412,509*	**19·47**	*18·99*	*19·29*
ENGLAND	Potatoes ..	**2,369,465**	*2,702,161*	**399,586**	*436,940*	**5·93**	*6·18*	*6·24*
	Turnips and Swedes ..	**12,147,635**	11,068,406	**879,684**	878,196	**13·81**	12·60	12·99
	Mangolds	**7,131,711**	7,627,153	**365,631**	401,048	**19·51**	19·02	19·32
WALES	Potatoes ..	**134,421**	155,932	**28,362**	26,459	**4·74**	5·89	5·38
	Turnips and Swedes ..	**837,753**	*738,851*	**52,682**	*50,753*	**15·90**	*14·56*	*15·42*
	Mangolds	**205,967**	206,927	**11,319**	11,461	**18·20**	18·05	18·17

NOTE.—The average yield of Potatoes in England and Wales is estimated t 5·85 tons per acre, or just one-third of a ton below the yield of 1915 and the en-years average ; *with a somewhat reduced acreage, the total production* f two and a half million tons is about 350,000 tons less than last year, but nly 180,000 tons below the average. Turnips and swedes have produced lmost 13 million tons, which is nearly 1,200,000 tons more than in 1915 ; the ield per acre (13·93 tons) is about one and a quarter tons more than in 1915, our-fifths of a ton above the average, and the best yield since 1910. Mangolds, n a considerably reduced acreage, gave about half a million tons less than ıst year ; but the yield per acre is also the largest since 1910, being half a on per acre better than last year, and one-fifth of a ton above the average.

Offer of Rennet from Canada.

THE Board have received a communication from a Toronto firm of rennet manufacturers regarding the possibility of finding a market for their rennet extract in this country. They state that they are in a position to ship 500 gal. per week in 40-gal. barrels. The price quoted, f.o.b. Toronto, is $4.85 (approx. £1) per gal. in contracts of 100 gal. per week, put in new oak kegs paraffined on the inside and varnished on the outside. Their standard goods are on the basis of 3 oz. of extract to coagulate 1,000 lb. of milk in 25 min. at 86° Fah. The name of the firm will be furnished on application to the Board.

Food-growing on Vacant, Common, or other Land.

THE following Regulation under the Defence of the Realm Acts was contained in an Order in Council, published in a supplement to the *London Gazette*, of 5th December, 1916:—

2L.—(1) Where the Board of Agriculture and Fisheries are of opinion that, with a view to maintaining the food-supply of the country, it is expedient that they should exercise the powers given to them under this regulation as respects any land, the Board may enter on the land,

(*a*) without any consent, if the land is for the time being unoccupied, or was unoccupied on the twenty-ninth day of November, nineteen hundred and sixteen, or if the land is common land, and

(*b*) in any other case, with the consent of the occupier and the person in receipt of the rent of the land,

and cultivate the land, or arrange for its cultivation by any person either under a contract of tenancy or otherwise.

(2) The Board may, after entry on any land, do or authorise to be done all things which they consider necessary or desirable for the purpose of the cultivation of the land or for adapting the land to cultivation, including fencing, and may also during their occupation of the land or on the termination thereof, remove any such fencing or work of adaptation.

(3) Any person who cultivates land under any such arrangement shall, on the determination, by or on behalf of the Board, of the arrangement, if the determination takes effect before the first day of January, nineteen hundred and eighteen, receive from the Board such compensation as may have been agreed under the terms of the arrangement, or, in default of any such agreement, as the Board may consider just and reasonable, and shall not be entitled to any other compensation.

(4) On the determination of the occupation of any land by the Board under this regulation, compensation shall be paid by the Board to any person injuriously affected by any deterioration of the land caused by the exercise of the powers under this regulation, the amount of that compensation to be determined, in default of agreement, by a single arbitrator under and in accordance with the provisions of the Second Schedule to the Agricultural Holdings Act, 1908.

(5) The Board may, with respect to any land, authorise any local authority to exercise on behalf of the Board any of the powers of the Board under this regulation.

(6) In this regulation the expressions "occupied" and "unoccupied" refer to such occupation as involves liability to payment

of poor rates, and the expression "common land" includes any land subject to be enclosed under the Inclosure Acts, 1845 to 1882, and any town or village green and any other land subject to any right of common.

(7) This regulation (except the last preceding sub-section) shall apply to Scotland with the substitution of the Board of Agriculture for Scotland for the Board of Agriculture and Fisheries, of arbiter for arbitrator, and of the Agricultural Holdings (Scotland) Act, 1908, for the Agricultural Holdings Act, 1908; and as regards Scotland "unoccupied land" shall mean land in respect of which no person was entered as tenant or occupier in the valuation roll for the year ending on the fifteenth day of May, nineteen hundred and seventeen.

The Cultivation of Lands Order, 1916.

THE following Order is the Cultivation of Lands Order, 1916, dated 8th December, 1916, made by the Board of Agriculture and Fisheries under Regulation 2L of the Defence of the Realm (Consolidation) Regulations, 1914:—

Whereas under Regulation 2L of the Defence of the Realm (Consolidation) Regulations, 1914 (which was inserted in those Regulations by Order in Council, dated the fifth day of December, nineteen hundred and sixteen, and is set out at the foot of this Order), the Board of Agriculture and Fisheries (hereinafter referred to as "the Board") are empowered to exercise certain powers with a view to maintain the food supply of the country and to authorise any Local Authority to exercise those powers on behalf of the Board.

And whereas the Board are of opinion that for the purpose aforesaid such Order should be made as is herein contained.

Now the Board of Agriculture and Fisheries do hereby authorise the council of the administrative county of London and the council of each municipal borough and urban district to exercise on behalf of the Board the powers conferred by Regulation 2L as respects any land within the county of London or the borough or district, or which in the opinion of the council can conveniently be cultivated by persons residing in the county of London or the borough or district, subject nevertheless to the provisions of this Order:—

1. A council shall not enter on any unoccupied garden or pleasure ground usually occupied together with a dwelling-house and shall not enter on any common land, as defined in Regulation 2L, without a further consent given by the Board.

2. A council shall as soon as possible after entry on any unoccupied land give notice of the entry to the owner of the land.

3. A council may in the case of occupied land agree to pay a rent for the use thereof but not in excess of the rent payable by the occupier for the land, or if held with other land, in excess of a fair proportion of the total rent so payable, or where the land is occupied by the owner, in excess of the annual value for the purposes of income tax together with the tithe rentcharge (if any).

4. A council may arrange with any society having for its object the cultivation of vacant land for the cultivation of any land on which

the council has entered, by and delegate to such society such of the powers of the council under this Order as may be necessary for the purposes of the arrangement.

5. A council may purchase any seed, manures or implements required for the cultivation of the land and sell any article so purchased to the cultivators, or allow their use of the implements at a price or charge sufficient to cover the cost of purchase.

6. A council shall, as far as practicable, arrange that the payments made by the cultivators for the use of the land shall cover the cost incurred by the council in providing the land or adapting it for cultivation, and shall not incur any expenses in the exercise of the powers hereby conferred (except in respect of compensation payable under paragraphs (3) and (4) of Regulation 2L) which will involve the Board in a liability to repay the council a total amount exceeding two pounds for each acre provided by the council.

7. An arrangement with a person or society for the cultivation of the land shall be subject to determination by the council or the Board at any time by notice to that person or society, and shall not provide for payment of compensation to that person or society in excess of the value at the time of quitting of the crops growing on the land and the labour expended upon and manure applied to the land since the taking of the last crop in anticipation of a future crop, or provide for the payment of any compensation if the determination takes effect on or after the 1st January, 1918.

8. The land shall not be used for the production of vegetable crops which continue productive for more than one year or for grazing.

9. A separate account shall be kept by a council of all its receipts and expenditure under this Order, which shall at any time be open to inspection by an officer of the Board.

10. This Order applies only to England and Wales.

11. This Order may be cited as the Cultivation of Lands Order, 1916.

In witness whereof the Board have hereunto set their Official Seal this eighth day of December, nineteen hundred and sixteen.

(L.S.) SYDNEY OLIVIER, *Secretary*.

THE following Circular Letter, dated 12th December, 1916, has been addressed by the Board to the London County Council and the Councils of Boroughs and Urban Districts in England and Wales :—

The Cultivation of Unoccupied Land.

SIR,—1. I am directed by the President of the Board of Agriculture and Fisheries to inform you that a Regulation* has been made by Order in Council under the Defence of the Realm Consolidation Act, 1914, with the object of increasing the food supplies of the country by extending the existing powers of providing land for cultivation.

2. Acting under this Regulation, the Board have made the enclosed Order,† in which the Regulation is embodied, empowering allotment

* See p. 905. † See p. 906.

authorities in urban areas to exercise on behalf of the Board the powers conferred by the Regulation.

3. The principal object of the Regulation and the Board's Order is to secure the cultivation of unoccupied land in districts where labour for such cultivation is available by authorising Local Authorities to take possession of such land without the necessity of obtaining any consents, but power is also given to take possession of occupied land by agreement with the owner and occupier and to take possession of common land with the consent of the Board.

4. I am to make the following observations for the information and guidance of your Council on the principal points arising under the *Regulation and Order* :—

ACQUISITION OF LAND.—5. Land may be taken, either within the area of the Council or outside its area, if it can conveniently be cultivated by persons residing within the area. It falls into three classes :—

(*a*) Unoccupied land. The Councils named in the Order may enter forthwith on any unoccupied land, with the exception of gardens or pleasure grounds usually occupied together with dwelling houses. Notice of entry must be given to the owner. (*See* paragraph 6 of the Regulation as to definition of "unoccupied.")

(*b*) Occupied land may be taken by agreement with the owner and occupier.

(*c*) Common land may be taken subject to the consent of the Board in each case, but consent will not be given to any scheme which would damage materially the natural beauty or amenities of a common or which would seriously prejudice the interests of the commoners or the public. Moreover, the Board will not consent to schemes for the taking of parts of commons unless they are satisfied that the local demand cannot reasonably be met from the other classes of land.

TENURE OF LAND TAKEN.—6. The Order in Council has effect only during the War, and accordingly the right of the Board, and of those claiming under them, to retain possession of land under the authority of the Regulation terminates at the end of the War, but under the Defence of the Realm (Acquisition of Land) Bill of this Session it is proposed that the Board shall have power to extend the period of occupation under this Regulation for such period as may be necessary for securing any annual crop growing at the end of the War.

7. Though cultivators cannot, therefore, count with certainty on more than one year's crops from the land, this should repay the labour expended in preparing the land and the cost of seed and manure.

8. The Board or a council can give up possession of the land at any time, and this should be done whenever they are satisfied that the land is required by the owner for immediate use for building or other exceptional purposes.

RENT PAYABLE FOR LAND TAKEN.—9. No rent will be payable by a council for any unoccupied or common land taken under the Order. For occupied land such rent will be paid as may be agreed with the owner and occupier, provided that it does not exceed the limit imposed by article 3 of the Board's Order.

LETTING OF LAND TAKEN.—10. Land taken under the Order may be let by the local authority for cultivation in small allotments either to a society or to individual cultivators. Councils are advised, where possible, to arrange for the letting to or through the agency of any existing society operating in its district, or to one formed for the purpose, and power is given by the Order to delegate to such society all the powers of the Council except the actual taking of the land. In the case of land let to individual cultivators it has been found by experience that, as a general rule, 10 rods is sufficient for each cultivator.

RENT PAYABLE BY CULTIVATORS.—11. Councils should arrange, as far as possible, that the expenses of providing land should be recouped by payments made by the cultivators. In the case of unoccupied or common land, where no rent is paid by the Council, it may not be necessary to charge more than a nominal rent to the cultivators, but if rent is paid by the Council for occupied land the rents charged should be sufficient to cover the payments.

ADAPTATION OF LAND FOR CULTIVATION.—12. Councils a e authorised to do all things which are necessary or desirable to adapt any land taken for cultivation, including fencing, but it would obviously be unprofitable to incur any considerable expense on land held for a short and uncertain period. In some cases it may be essential to provide fencing, but, as a general rule, the responsibility of protecting the plots from trespass or pilfering should be placed on the cultivators themselves. Notices might be posted asking the public not to trespass on or damage the plots. Councils who have horses and the necessary implements available can render valuable assistance by breaking up the land in the first instance.

PROVISION OF SEED, MANURES OR IMPLEMENTS.—13. The Order authorises councils to provide seed, manures or implements at cost price to the cultivators. It will therefore be possible to arrange for the purchase in bulk of seed potatoes, for instance, a form of assistance which would be of the greatest possible value. If there is a military camp in the neighbourhood it will often be possible to obtain manure at very reasonable rates.

RESTRICTIONS ON USE OF LAND TAKEN.—14. Land taken under the Order may not be used for the production of fruit or vegetable crops which remain productive for more than one year, or for grazing. The limited period of occupation makes it undesirable to allow such crops as rhubarb or asparagus, which can be grown profitably only when several crops can be taken, and the principal object of the scheme is to stimulate the growth of substantial foodstuffs, such as potatoes, rather than luxury crops. The use of land for grazing is prohibited in order to secure the greatest possible production from the land. It is not, however, intended to prohibit the keeping of poultry, rabbits, etc., if a council thinks this is desirable in combination with the cultivation of the land.

EXPERT ADVICE TO CULTIVATORS.—15. The Board hope that councils will endeavour to arrange for expert assistance to the cultivators in the preparation and cultivation of their plots. The Royal Horticultural Society, Vincent Square, S.W., has readily promised its active help, through the agency of its members, who are scattered all over the country, and the co-operation of professional gardeners and

nurserymen should be invited. A list of the Leaflets issued by the Board is enclosed, many of which should be of considerable assistance to the cultivators. Copies of any of the Leaflets will be sent on *application.*

COMPENSATION ON QUITTING.—16. Owners of land taken under the Order will be entitled, when the occupation of a council under the Regulation terminates, to compensation for the deterioration (if any) of the land caused by its use, the compensation being determined, in default of agreement, by arbitration in accordance with the procedure of the Agicultural Holdings Act, 1908.

17. Cultivators of land taken under the Order will not, in normal circumstances, be entitled to any compensation on quitting, as the possibility of retaining possession after the end of the War until the growing crop is secured should allow of arrangements being made so that the land should be vacated at a time of year and with sufficient notice to obviate any loss to the cultivators. But the Order provides that if in any case the tenancy of an allotment is terminated prior to 1st January, 1918, compensation may be paid in accordance with paragraph (3) of the Regulation and article 7 of the Order.

18. Any compensation payable as above, either to owners or cultivators, will be defrayed by the Board.

FINANCE.—19. In exercising their powers under the Order, councils will be acting on behalf of the Board, and no charge will fall on the local rates. It is hoped, as stated above, that in most cases the expenses of providing land will be recouped by the payments from the cultivators, but any deficiency will be met by the Board, provided that, apart from the compensation referred to in the preceding paragraph, it does not exceed a total sum of £2 for each acre taken by the Council. Within this limit councils are authorised to incur expense in carrying out their powers under the Order. A separate account must be kept of all receipts and expenditure under the Order, which will be open to inspection at any time by an officer of the Board, and the Board will settle any claim by a council as soon as the occupation of the land terminates.

LOCAL CONTROL.—20. The powers of councils under the Order have been set out in some detail in order to avoid as far as possible the need for correspondence with the Board on the subject. The President is most anxious that Local Authorities, who are familiar with local conditions, should be free to use their own discretion to the fullest extent, and that they should be as little fettered as possible by departmental control. Moreover, the heavy pressure of work on the depleted staff of the Board makes it impossible for them to deal with a mass of additional correspondence on the subject. It is hoped, therefore, that, with the information given in this Letter, councils will be able to administer the Order without reference to the Board.

APPEAL TO OWNERS AND OCCUPIERS OF LAND.—21. In many parts of the country there are considerable areas of land which, though *technically occupied, are not fully cultivated owing to shortage of* labour or other causes. Such land, especially if it is close to urban areas where spare-time labour for more intensive cultivation is available, *might with great advantage be used temporarily for the purposes of* the Order. The Board feel sure that owners and occupiers will be ready to assist Councils by placing suitable portions of such land at

their disposal and that many of them will be willing in addition to give materials for fencing and help in laying out the plots and preparing the soil.

GENERAL OBSERVATIONS.—22. The President desires me, in conclusion, to commend the matter to the earnest consideration of your Council and to ask that no time may be lost in putting into operation the powers conferred by the Order. Public notices should be issued at once inviting applications from societies or persons who are willing to undertake the cultivation of land which can be acquired under the Order. The matter is urgent, as, if land is to be in the best condition for putting in spring crops it is desirable that it should be broken up before the winter is over. The President realises that local authorities are already seriously overburdened with work, but the urgency of increasing the food supply by all possible means is such that he feels sure he can rely on the active co-operation and assistance of your Council. The work which has been done in London by the Vacant Land Cultivation Society, 14, Buckingham Street, Strand, W.C., and by similar societies elsewhere, has proved that excellent crops of potatoes and other vegetables can be grown on most unpromising sites, and if similar efforts are made in other urban areas a very substantial addition will be made to the food supplies of the nation. The success of the scheme will depend upon cordial co-operation among all those who desire to increase our food production, and the President feels sure that there will be no lack of goodwill on the part either of local authorities or of landowners and occupiers, and that men and women of all classes will come forward and give all the time and labour they can spare so as to secure that every available acre should be making its contribution to our home-grown supplies of food.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

PARLIAMENTARY QUESTIONS AND REPLIES ON AGRICULTURAL MATTERS.

Home Production of Food.—Mr. Acland (11th December), dealing with questions put by Captain Bathurst, said: I will reply by stating what has been and is being done since the short harvest abroad, the development of submarine activity, and the bad weather of the last two months have made it clear that a very special effort must be made to maintain home food production.

1. It was arranged that farm workers should not be taken into the Army until 1st January in the case of ordinary labour, and 1st April in the case of men employed on milk production.

2. The organisation for assisting agriculture through war agricultural and women's county and district committees has been reviewed and strengthened, and the different bodies have been brought into closer co-operation.

3. All urban authorities are being given powers of taking unoccupied land compulsorily, whether within or without their areas, for allotment cultivation, and are being urged to use these powers energetically at once.

4. The War Office is being assisted in working out schemes for contracting with farmers for the cultivation of certain crops next year—seed and manures being supplied if necessary.

5. Arrangements are being made for the employment of German prisoners to supplement the labour left on farms—the previous conditions as to areas and numbers having been withdrawn. This is being pressed forward very actively, and it is hoped through local agencies to bring pressure upon any farmers who may not be willing to employ this or other available types of labour, so that the maximum amount of labour may be employed upon the existing arable area.

6. It is believed that more prisoner labour may be made available than is required on farms, and, if so, this will be employed on bringing under cultivation such areas of land as are likely to yield a crop next year.

7. We hope to make arrangements with the Ministry of Munitions for increasing the output of implements and machinery. As to obtaining motor ploughs and tractors from America, British firms now have more on order than can be supplied—though arrangements have been made for their shipment—or than they have labour to assemble after they have been delivered, but inquiries are being made whether the output of tractors suitable for British conditions can be quickly stimulated, and they will be procured if possible.

8. The labour question with regard to the position of the essential skilled men now on farms after 1st January is still being considered with the War Office, and the President of the Board is of opinion that it will not be safe to take more men, except in cases where there are still men above the agreed scale, or on substituting capable men with agricultural experience. He believes that it will be necessary to supplement this source of labour by giving home-service men extended furlough for seeding operations if production is to be maintained. He is, however, willing and anxious to arrange that if labour now likely to be taken in January is left, this shall only be done where the farmers will guarantee to cultivate certain areas of the most essential food supplies.

Training School for Women Farm Workers at Shaw, Wiltshire.—Mr. Peto (21st November) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware that the training school for women farm workers at Shaw, in the county of Wiltshire, has been closed by the Wiltshire War Agricultural Committee; whether the reason for the closing of the school is that the country and farm work grew too monotonous for town girls to put up with; and whether he can make any general statement of the success or otherwise of schemes for training women for agricultural work?

Mr. Acland: I am glad to have an opportunity of correcting the erroneous impression which has been created by some of the published statements on this matter. The training school at Shaw was started by a private committee, not by the Wiltshire War Agricultural Committee, and it was decided to close it for the winter, mainly because of its isolated position and because the matron could not continue her services. Some few of the girls found farm work too hard, but the majority have been placed and are doing well, and there is no ground for the current impression that the experiment as a whole was a failure. It is obvious that careful selection of girls for farm work is necessary, but where this has been done the results have been almost uniformly

successful, and the Board have numerous instances of town girls who have been trained as milkers, etc., and who are proving of the greatest possible assistance to farmers. The success of women in farm work has considerably surpassed general expectations.

Purchase of Wool.—Mr. Ellis Davies (15th November) asked the Financial Secretary to the War Office whether he is aware that whilst hitherto wool in Carnarvonshire had been bought in bulk it is now graded, and that in consequence the price paid for it is in many cases less than the price paid in 1915 and less than the promised price of 35 per cent. on the price of 1914; and whether, in view of the fact that the seller is not represented at the grading of the wool or its valuation, what protection is afforded to the farmer?

Mr. Forster: Clips of 200 fleeces and under in Wales may be bought outright by authorised merchants on their own valuation without casing. In the valuation of larger clips on behalf of the Department casing is necessary in order to check the preliminary valuation and to protect the War Office and the farmer from mistakes as to the quality and condition of the wool. Invoices and casing returns are submitted to the Department's district executive officer before final payment is made, and if the farmer is dissatisfied with the casing return and the valuation of the authorised merchant he may appeal to that officer. If the hon. Member will supply me with particular cases where the prices paid have been less than the standard prices approved by the Central Advisory Committee for Wool Purchase, which were based on the average prices ruling in June and July, 1914, with the addition of 35 per cent., I will have the necessary inquiries made.

Mr. Prothero (21st November) asked the Secretary of State for War whether he is aware that the delay in taking delivery of the wool-clip, and in making payment for the purchase, is causing inconvenience to farmers, and, from want of proper storage, deterioration in the value of the wool; and whether he will take steps to expedite the completion of the transaction?

Mr. Forster: Over 60 per cent. of the wool of the United Kingdom has been delivered, valued, and paid for to date. This rate of progress is quite as fast as in normal times, and, as far as the War Office is concerned, I may say that payment is made on the same day that the invoices are received. The hon. Member is no doubt aware that the wool is collected through the usual trade channels and that practically every wool merchant in the country is occupied in the valuation and classing of wool. Wool merchants have given their fair proportion of men to the Army and are suffering like other trades from shortage of labour. It is, therefore, unreasonable to expect them to handle 100,000,000 lb. weight of wool at a faster rate than in times of peace. No case of deterioration owing to bad storage has been brought to my notice, and every farmer has been expressly instructed to notify the district executive officer if he has insufficient storage accommodation, in order that special arrangements may be made for taking delivery of his wool.

Sale of Hay.—Mr. T. Wilson (21st November) asked the Financial Secretary to the War Office if he is aware that farmers who use their land mostly for grazing purposes, and who grow very little hay, are finding it extremely difficult to get hay for feeding their cattle owing to the restrictions placed upon the sale of hay; and whether he can see his

way to relax the restrictions so far as the sale of meadow hay is concerned, so that these farmers may be able to buy hay to feed their stock ?

Mr. Forster : I am not aware that the difficulties referred to are at all general, and any specific cases that are brought to notice are specially dealt with. I am informed that, speaking generally, the amount of hay released for use of civil consumers is largely in excess of the quantity being purchased by them, and I regret that the restrictions cannot be relaxed as suggested by my hon. Friend.

Feeding Wheat to Pigs.—Mr. Carew (23rd November) asked the Parliamentary Secretary to the Board of Agriculture whether he is aware of the fact that a good deal of wheat is now being ground up for feeding pigs, owing to the short supply of barley in this country ; and whether some steps will be taken to prevent this being done ?

Mr. Acland : The feeding of any millable wheat to pigs or the using of it for any purpose other than human food, is strongly to be deprecated, and steps may have to be taken to adopt such measures as are possible to prevent it.

Seed Potatoes.—Mr. Dixon (23rd November) asked the Parliamentary Secretary to the Board of Agriculture if he has considered the probability of a serious shortage of seed potatoes in the spring, and the advisability of prohibiting the sale of potatoes for consumption on a smaller riddle than 1⅝ in. until 14th April, 1917 ?

Captain Bathurst asked what steps, if any, are being taken to prevent a serious shortage of seed potatoes next spring by the use by potato merchants of a 1¼-in. instead of the usual 1⅝-in. riddle ?

Mr. Acland : The action suggested has been fully considered, but the Board have come to the conclusion that until after the census of potato stocks now being taken has been completed any regulation would be premature. The proportion of tubers passing through the riddle of 1⅝-in. mesh is larger this year than usual on account of the unfavourable season, and many of these small tubers which are now being sold for food would be quite unsuited for seed purposes. It is the general practice of growers in England and Wales to retain for their own use such of their small potatoes as may be suitable for seed, and few growers are likely to risk the disposal of their whole crop of seed potatoes unless they have already arranged for an adequate supply from elsewhere. I think my hon. Friends really know that the question is far too complicated and difficult to be settled simply by prescribing the use of riddles with a certain size of mesh, but they can be assured that the position is being very carefully studied and watched.

Feeding Acorns to Pigs.—Mr. Pennefather (27th November) asked the Parliamentary Secretary to the Board of Agriculture if he is aware that acorns are a valuable food for pigs and some other live stock ; and will he, in view of the scarcity and high prices of other feeding stuffs, endeavour to organise the collection and distribution of the acorns which are now falling and being wasted ?

Mr. Acland : The value of acorns as a food for pigs and other live stock has been continuously pressed upon farmers by the Board, and I believe that they study their own interests sufficiently to take the action which the hon. Member suggests wherever it is possible to do so. But I am obliged to him for the opportunity his question gives of once more bringing the matter to the farmers' notice.

Milk Contracts.—Sir J. Spear (27th November) asked the President of the Board of Trade if contracts to supply milk extending to Lady Day next will be annulled on 1st January in cases where the price agreed on is above the Government maximum; and, if so, will he provide that a breach of contract under these circumstances shall not be liable to financial penalty?

Mr. Pretyman: Should no supplementary Order be made, the price which may be charged for milk delivered after 31st December next will be required to be within the limits laid down in the recent Price of Milk Order. The effect on contracts after the 1st January raises a legal question on which I cannot express an opinion.

NOTES ON AGRICULTURAL CO-OPERATION.

Agricultural Organisation Society's Report, 1915-16.—The annual Report of the Agricultural Organisation Society for the year ending 31st March, 1916, indicates that, in spite of the many difficulties of the times, the co-operative movement continues to make steady progress. The number of registered societies affiliated to the Agricultural Organisation Society on 31st December, 1915, was as follows:—

Farmers' Co-operative Societies:—	
Purchase of Agricultural Requirements ..	213
Dairy	38
Eggs and Poultry	29
Co-operative Auctions, Fruit Societies, etc...	27
Total	307
Land-renting Societies (Small Holdings and Allotments)	177
Credit Societies	48
Agricultural and General Co-operative Insurance Society	1
Farmers' Central Trading Board	1
Miscellaneous Associations	16
Total Number of Registered Societies	550

These figures do not include a considerable number of depots under the management of societies, nor eleven women's institutes which had been formed.

During the year, 1st April, 1915, to 31st March, 1916, forty new societies were registered, and, in addition, fifteen women's institutes were formed.

The agricultural co-operative movement in England and Wales is not confined to the purchase of feeding-stuffs, fertilisers and agricultural requirements. A very considerable trade is done by the societies in the disposal of farm produce, and many societies formed for the purchase of agricultural requirements now deal in one or more classes of farm produce.

(*a*) *Societies for the Purchase of Agricultural Requirements.*—Farmers have never been more willing than now to join co-operative societies. The difficulties in securing their usual supplies have brought home to them in a forcible way the advantages to be derived from joint effort. Practically all the societies in this group had a remarkably good year, in spite of the requirements, particularly cakes and feeding-stuffs, reaching very high prices.

(*b*) *Dairy Societies.*—Satisfactory prices have been received by societies for milk and dairy produce sold by them, and the prices given by them to the farmers have materially improved. The collection of milk from farmers by motor-lorry has been started in a few districts and is giving satisfaction. There is an increasing tendency among farmers in the north of England to desire to co-operate for the purpose of retail delivery of milk, and the small number of retail societies already existing was added to by the formation of a society at Blackpool for the purpose. More attention is being given to cheese-making, especially as a means of dealing with surplus milk.

(*c*) *Egg and Poultry Societies.*—These societies show an increase both in regard to turnover and number, the greatest turnover being shown by societies which have adopted the system of working through numerous sub-depots. Information is sent to all egg-collecting societies as regards market prices by the Egg Intelligence Bureau of the Agricultural Organisation Society. Comparison with other countries shows that in the Framlingham Society, the egg department of the Eastern Counties Association and the Golden Vale Society, England possesses three of the largest co-operative organisations, apart from federations, for the collection of eggs in Europe. Between them these three societies deal with over seventeen million eggs annually.

(*d*) *Disposal of Fruit and Market-garden Produce.*—Some trouble was experienced by growers in getting their produce to market, owing to the exceptional conditions prevailing. This points to the advisability of consigning to local markets as long as a fair return seems likely, instead of to distant centres on a doubtful chance of obtaining higher prices. Satisfactory results have accrued from the assistance given to some industrial co-operative societies, which erected a special plant for preserving fruit by pulping, jam-making and bottling.

(*e*) *Sale of Wool.*—There was a further extension of the movement for the co-operative selling of home-grown wool in the London market.

(*f*) *Land-renting Societies* (*Small Holdings*).—In the year 1914 there were 147 co-operative small holdings and allotments societies at work, with a total membership of 16,205, compared with 131 societies with 14,471 members in 1913. Their total capital was £49,665. These societies held 15,432 acres of land, for which £26,657 was payable by them for rent, rates and taxes; 15,017 acres were let to 12,234 tenants, who paid £31,139 to the societies for rent, rates and taxes. A number of the societies have formed trading departments for the purchase of members' requirements and for the sale of their produce. The total sales by the societies amounted to £3,471, and the net profit of the whole of the operations in 1914 was £215.

(*g*) *Allotments.*—An increased demand for gardens has arisen in many districts, and a considerable number of fresh allotment associations have been registered during the past year, and particularly during the latter part of it.

(*h*) *Agricultural Credit.*—Numerous attempts have been made to initiate a satisfactory system of credit in this country, and some fifty

credit societies have been formed by the Agricultural Organisation Society. Their success has been very limited, and the number, in comparison with other countries, where they exist in thousands and are most successful, is totally inadequate.

(*i*) *County War Agricultural Committees.*—The Agricultural Organisation Society has placed its services at the disposal of the War Agricultural Committees, whose main object has been to increase the home-grown food supplies. In some counties direct representation has been given to farmers' co-operative societies, and in Glamorganshire the societies themselves have been appointed to act as the district committees.

(*j*) *Women's Institutes.*—The objects of these institutes are: To study home economics; to provide a centre for educational and social intercourse; to encourage home and local industries; to develop co-operative enterprises, and to stimulate interest in the agricultural industry. Up to 31st March, 1916, fourteen institutes had been formed. The different programmes include lectures on co-operative marketing, poultry keeping, egg production, increased food production, gardening, herb growing and collecting, rabbit keeping, goat keeping, hay-box cookery, bread making, dairy work, village industries, child welfare, diet for school children and local history.

(*k*) *Village War Food Societies.*—Several of these societies have been brought into existence. Their objects are to increase the growing of vegetables, to encourage allotment cultivation, and especially to make use of uncultivated land.

Cattle Insurance Societies in India.—Cattle insurance societies have been in operation in Burma for the last five or six years, and have so far proved eminently successful. Efforts are now being made to introduce these societies into the United Provinces, and a few societies have been registered. At present insurance is confined to healthy bullocks and male buffaloes between the ages of 4 and 12 years. The premium has to be paid every six months on the value of the animal as assessed by the society. The rate of premium has been provisionally fixed at one pice per rupee (1*d.* per 5*s.* 4*d.*) for the six months, and should the animal die during that period the owner will receive two-thirds of its value after deducting the value of the hide, etc. No compensation is given if the animal dies through the owner's neglect, and provision is made to meet cases of epidemic, and also for treatment for sickness. If the scheme proves successful and the number of societies increases a re-insurance society will be organised.

In Burma the area of a cattle insurance society is usually limited to one village, and membership is practically confined to the members of a credit society. Members are urged, but not compelled, to insure all their eligible cattle. Plough bullocks and buffaloes are insurable. The valuation is made every six months when the premium (5 per cent.) has to be paid. If an animal dies, two-thirds of the assessed value, less the price of the hide and carcass, is paid out. The societies have two separate funds, (1) the general fund consisting of all premiums realised during the year, and (2) the reserve fund consisting of fines, entrance fees, donations, profits of previous years, etc. A re-insurance society has been formed for the whole of Burma. This society receives half the premiums and pays half the indemnity. In the event of the primary society being unable to pay its half of the indemnity from the

general fund, half the reserve fund may, with the consent of the registrar, be used for this purpose. If the funds are still insufficient the indemnities on animals that have died during the year are correspondingly decreased. (*Agricultural Journal of India*, 1916).

Co-operative Societies in Russia for the Leasing of Land.—Co-operative societies have been formed in many of the agricultural governments of Russia for the farming of land. Large tracts of fallow land belonging to large landowners or to the Crown are leased at a low price and sub-let in small lots to members of the society. This leasing was formerly done by speculators who sub-let at high rents. Four societies have been formed in the Kherson government, two in the Kursk government, and one each in the Tambov, Stavropol, Chernigov, Saratov and Orenburg governments. One of the Kherson societies is letting land at 14*s.* per acre as against the prevailing rent of 19*s.* 6*d.* in the surrounding area, and another at 13*s.* 6*d.* as against 15*s.* 6*d.*

As a result of this new feature of the agricultural life of Russia better use is being made of the soil. The societies insist on a rational system of cultivation, rotation of crops, cleaned and sorted seed grain, and in certain cases on fertilisers. It has been noticed that the members not only submit willingly to these conditions, but, as experience shows the wisdom of them, extend their application farther than they had contracted to do. One society, for instance, insisted on a complicated cultivation of the soil with a view to getting rid of wild oats. Such cultivation was at first applied to isolated plots only, but has now become the general rule. (*Torgovo—Promishlennaya Gazeta*, 17/30 August, 1916.)

Proposed Spanish Agricultural Bank.—The Spanish Minister of Finance was authorised by a Royal Decree, dated 24th September, to present to the Cortes a Bill to provide for the formation of a National Agricultural Bank.

The text of the Bill, as published in the "Gaceta de Madrid" of 2nd October, provides for the establishment of the headquarters of the Bank at Madrid, and, within two years from the date of its formation, branches are to be opened in each of the agricultural districts of Spain. The Bank is to grant cash loans in connection with the improvement and extension of agriculture generally, while other functions of the Bank include the acquisition of land to be leased to cultivators; the acceptance of bills and granting security for obligations; the purchase in Spain or from abroad of fertilisers, farm implements, seeds, machinery, cattle, etc. to be re-sold in Spain; the establishment of warehouses, grain silos, and depots for agricultural produce and the issue of securities for the goods deposited in them; the sale on commission of agricultural or cattle products in Spain or abroad, establishing the agencies necessary for that purpose; the effecting of agricultural insurances.

It is further provided that the capital of the Bank is to be 100,000,000 pesetas (£4,000,000 at par), of which the State would be responsible for 25,000,000 pesetas, the remainder being subscribed either by competition among Spanish banking concerns or by public subscription. These 75,000,000 pesetas will be represented by registered shares ("acciones nominativas"). The shares in the hands of foreigners must not exceed one-fifth of the capital issue. (*Board of Trade Journal*, 26th October, 1916.)

MISCELLANEOUS NOTES.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural and Commercial Statistics* for November, 1916, issued by the International Institute of Agriculture, contains data showing approximately the outcome of the world's harvests for 1916. The countries in respect of which such data are available are as follows:—

In *Europe*—Spain, England and Wales, Ireland, Italy, Norway, Netherlands, Rumania, Russia in Europe (48 Governments), Switzerland; in *America*—Canada, United States; in *Asia*—British India, Japan; in *Africa*—Egypt, Tunis.

Wheat.—The total production in the above countries is estimated at 277,783,000 qr. in 1916, against 383,755,000 qr. in 1915, a reduction of 27·6 per cent., the area sown showing a decrease of 13·2 per cent.

Rye.—In the above-mentioned countries, excluding England and Wales, Rumania, British India, Japan, Egypt and Tunis, the total production is placed at 109,279,000 qr. this year, as compared with 115,724,000 qr. last year, the decrease being equal to 5·6 per cent., while the area sown was smaller by 4·4 per cent.

Barley.—In the above-named countries, excluding British India, the production is estimated to amount to 114,995,000 qr. in 1916, or a decrease of 10·0 per cent. compared with 1915, when it amounted to 127,769,000 qr., the area sown showing a reduction of 3·0 per cent.

Oats.—In the specified countries, with the exception of British India, Japan and Egypt, the total production is estimated at 282,447,000 qr. this year, against 339,370,000 qr. last year, the decrease being equal to 16·8 per cent., while the area sown was smaller by 1·2 per cent.

Maize.—The production of this crop in Italy, Russia in Europe (48 Governments), Switzerland, Canada, United States and Japan, is estimated at 327,128,000 qr. this year, against 381,758,000 qr. last year, or a decrease of 14·3 per cent., the area sown in 1916 being about the same as in the previous year.

France.—The Ministry of Agriculture estimates the present condition of autumn-sown crops in 62 departments as follows: Wheat ranges from 40 to 85, rye from 40 to 90, barley from 40 to 80, and oats from 40 to 85 (100=very good, 80=good, 60=fairly good, 50=passable, and 30=mediocre). (*London Grain, Seed and Oil Reporter*, 25th November.)

The production of the chief crops for 1916 is officially estimated as follows:—Wheat, 26,820,000 qr. as compared with 27,839,000 qr. last season; maize, 512,000 qr. against 504,000 qr.; rye, 4,186,000 qr. against 386,600 qr.; oats, 29,160,000 qr. against 24,460,000 qr.; and barley, 4,727,000 qr. against 3,813,000 qr. last season. *London Grain, Seed and Oil Reporter*, 29th November.

Italy.—Final official estimates of the production of wheat and maize are as follows: Wheat, 22,000,000 qr. as compared with 21,300,000 qr. last year; and maize 8,970,000 qr. against 13,800,000 qr. last year. (*Broomhall's Corn Trade News*, 4th November.)

Canada.—This season's wheat crop is officially estimated at 159,000,000 bush. as compared with 376,304,000 bush. last year, and 161,280,000 bush. in 1914. (*London Grain, Seed and Oil Reporter*, 25th November.)

Argentina.—According to a report, dated 19th October, from H.M. Minister at Buenos Aires, the area sown with wheat this season is 6,511,000 acres as compared with 6,645,000 acres last season; oats, 1,022,000 acres against 1,038,000 acres; and linseed, 1,298,000 acres against 1,619,000 acres.

Japan.—The total production of wheat, barley and rye this season is estimated at 14,426,358 qr., as compared with 14,744,494 qr. last season. (*H.M. Commercial Attaché, Tokio.*)

Agricultural Conditions in England and Wales on 1st December.

THE Crop Reporters of the Board, in reporting on the crops and the agricultural conditions in England and Wales on the 1st December, state that the weather of November was wet nearly everywhere, and comparatively little progress could be made with autumn work, so that the backward condition of farming noted last month was, on the whole, accentuated. Of the total area intended for wheat barely three-fifths have as yet been sown, though more progress appears to have been made in the important counties of Lincoln and Norfolk than elsewhere. As compared with the 1st December last year, the area actually seeded by this date would appear to be nearly 15 per cent. smaller, though here also the same counties are in advance of most of the country. Only that sown early or on light land is yet showing above ground, but it is looking well.

Root-lifting is late, and in practically every division there is a small quantity of mangolds still out. The weather having been open on the whole, little damage from frost is yet reported, except in Cambridgeshire. Large areas of turnips and swedes still remain to be got in. The condition and quality of the roots are satisfactory.

Live stock have done well during the month, and, with good crops of hay and roots, prospects of home-grown keep for the winter are satisfactory. In some districts straw is at present rather short as a result of the small proportion of corn that has been threshed this year.

Agricultural Labour in England and Wales during November.

ACCORDING to statements in the Board's *Monthly Agricultural Report* of 1st December, 1916, the supply of labour continues to be very scarce in all directions, whether skilled or casual, and the scarcity has especially been felt in threshing, ploughing and root pulling. Martinmas hirings in the north showed a rise in wages, and only boys, with very few men, were in many cases obtainable.

The following are particulars for the different districts:—

Northumberland, Durham, Cumberland, and Westmorland.—Skilled workers were scarce, and temporary labour for turnip pulling was almost unobtainable. Wages advanced at the November hirings, but generally only boys were seeking work.

Lancashire and Cheshire.—Labour was everywhere deficient and wages were advancing.

Yorkshire.—There was a shortage of both skilled and casual labour; horsemen were particularly scarce, and root pulling was being done by women.

Shropshire and Stafford.—The supply of labour was very deficient, and there was practically no casual labour to be had.

Derby, Nottingham, Leicester, and Rutland.—There was a considerable shortage of labour, and it was found very difficult to replace skilled men who have been taken from the land.

Lincoln and Norfolk.—The supply was still very short, especially of casual labour, which was almost unobtainable.

Suffolk, Cambridge, and Huntingdon.—The very short supply of labour and the scarcity of temporary hands was causing much work to be left undone.

Bedford, Northampton, and Warwick.—Labour was still very scarce, and temporary labour was hard to obtain.

Buckingham, Oxford, and Berkshire.—The supply of labour was very short, and was especially felt in the case of threshers and ploughmen.

Worcester, Hereford, and Gloucester.—Labour was everywhere very short and temporary hands were difficult to obtain.

Cornwall, Devon, and Somerset.—The supply was still very short, and female labour was the exception in this division.

Dorset, Wiltshire, and Hampshire.—The supply of labour was very short throughout the division. Female labour was being employed to some extent, but temporary labour was very difficult to obtain.

Surrey, Kent, and Sussex.—Labour was still very deficient, and more especially amongst horsemen. Skilled labour was hard to obtain, and wages were rising.

Essex, Hertford, and Middlesex.—Labour was very scarce, and temporary hands were difficult to obtain.

North Wales.—Farmers in this division were getting necessary work done in spite of the shortage of men, which was acute.

Mid Wales.—Labour was becoming more difficult to obtain, and the outlook was not promising.

South Wales.—The supply of labour continued to be very short, and no casual labour was obtainable.

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on 1st December, 1916, certain diseases of animals existed in the countries specified :—

Austria (on the 25th November).—Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period 22nd October—4th November).—Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—31st October).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (month of October).—Anthrax, Glanders, Foot-and-Mouth Disease, Foot-rot, Swine Erysipelas.

Hungary (on the 25th November).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 6th—12th November).—Anthrax, Foot-and-Mouth Disease (1,768 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (*month of October*).—Anthrax. Blackleg, Swine Fever

Rumania (*for the period 5th—14th September*).—Foot-and-Mouth Disease, Sheep-pox.

Russia (*month of July*).—Anthrax. Cattle-plague, Foot-and-Mouth Disease (95,920 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Sweden (*month of October*).—Anthrax, Blackleg, Swin Erysipelas, Swine Fever.

Switzerland (*for the period 6th—12th November*).—Anthrax, Blackleg, Foot-and-Mouth Disease (3 " étables " entailing 38 animals, of which 3 " étables " were declared infected during the period).

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Denmark, Montenegro, Serbia, Spain.

The Weather in England during November.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.*		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 4th Nov.:								
England, N.E. ...	45·6	0·0	0·84	21	+ 4	6	2·0	—0·2
England, E.	48·3	+2·1	1·37	35	+21	7	2·7	0·0
Midland Counties ...	46·0	+0·7	1·51	38	+21	7	1·7	—0·5
England, S.E. ...	50·5	+2·5	2·28	58	+37	7	2·8	+0·1
England, N.W. ...	46·9	+0·3	1·68	43	+20	7	1·1	—1·0
England, S.W. ...	49·6	+1·4	2·07	53	+25	7	2·0	—0·5
English Channel ...	52·5	+0·9	1·68	43	+19	7	3·7	+0·7
Week ending 11th Nov.:								
England, N.E. ...	48·0	+3·4	0·55	14	— 1	4	1·8	—0·1
England, E.	48·0	+2·8	0·85	22	+ 9	4	2·7	+0·2
Midland Counties ...	47·4	+3·2	0·78	20	+ 4	4	2·1	+0·1
England, S.E. ...	49·1	+2·1	1·57	40	+20	3	2·6	+0·3
England, N.W. ...	48·3	+2·7	1·01	26	+ 4	6	0·9	—0·8
England, S.W. ...	48·9	+1·4	1·90	48	+21	6	1·6	—0·6
English Channel ...	50·7	0·0	1.59	40	+15	7	2·1	—0·6
Week ending 18th Nov.:								
England, N.E. ...	44·7	+1·6	0·89	23	+ 9	3	1·3	—0·5
England, E.	43·5	+0·1	0·57	14	+ 1	1	2·6	+0·5
Midland Counties ...	42·2	—0·3	0·71	18	+ 4	2	1·7	0·0
England, S.E. ...	43·1	—1·9	0·67	17	0	2	1·9	—0·2
England, N.W. ...	43·8	—0·3	0·20	5	—15	1	1·9	+0·3
England, S.W. ...	43·8	—2·1	0·95	24	0	3	1·1	—1·0
English Channel ...	46·9	—2·7	1·17	30	+ 7	4	1·4	—1·1
Week ending 25th Nov.:								
England, N.E. ...	43·3	+1·2	0·69	18	+ 5	5	1·8	+0·1
England, E.	43·1	+1·4	0·73	19	+ 7	5	1·8	0·0
Midland Counties ...	42·0	+0·7	0·66	17	+ 4	5	1·5	—0·1
England, S.E. ...	44·0	+0·5	0·86	22	+ 7	6	1·3	—0·5
England, N.W. ...	44·4	+1·4	1·11	28	+ 8	5	1·4	—0·1
England, S.W. ...	44·9	+0·3	0·93	24	+ 2	6	1·5	—0·4
English Channel ...	48·3	0.0	1·36	34	+14	6	2·4	+0·2

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	44	51	497	528
Animals attacked	54	52	590	594
Foot-and-Mouth Disease:—				
Outbreaks	—	28	1	48
Animals attacked	—	435	24	669
Glanders (including Farcy):—				
Outbreaks...	2	5	46	46
Animals attacked	2	7	114	80
Parasitic Mange:—				
Outbreaks	96	71	1,945	*774
Animals attacked	163	148	4,261	*1,661
Sheep-Scab:—				
Outbreaks	58	22	263	188
Swine Fever:—				
Outbreaks	254	264	4,057	3,714
Swine Slaughtered as diseased or exposed to infection	134	951	9,044	15,888

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	1	3	2
Animals attacked	—	1	7	2
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	1	4	59	68
Sheep-Scab:—				
Outbreaks	49	32	415	378
Swine Fever:—				
Outbreaks	17	17	294	236
Swine Slaughtered as diseased or exposed to infection	13	51	1,709	1,307

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in November and October, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	November.		October.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	13 6	12 11	13 3	12 8
Herefords	13 5	12 5	13 2	12 0
Shorthorns	13 6	12 3	13 3	12 1
Devons	13 4	11 9	13 7	12 2
Welsh Runts	13 1	12 1	12 10	12 0
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	11¾	11	—	10¾
Sheep :—				
Downs	13¼	12	12¾	11⅛
Longwools	12½	11⅛	12	11
Cheviots	13⅛	12½	13½	12¼
Blackfaced	13¼	12¼	12¾	11¾
Welsh	12¼	10⅛	11½	10¼
Cross-breds	13¼	12	12¾	11¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	12 9	12 1	12 11	12 3
Porkers	13 9	13 3	13 9	13 2
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	38 3	30 16	37 18	30 3
,, —Calvers ...	36 5	29 18	34 16	29 4
Other Breeds—In Milk ...	36 11	28 19	33 8	27 2
,, —Calvers ...	—	—	28 0	25 0
Calves for Rearing	3 8	2 14	3 8	2 15
Store Cattle :—				
Shorthorns—Yearlings ...	15 8	13 2	15 5	13 3
,, —Two-year-olds...	22 0	19 0	22 3	19 2
,, —Three-year-olds	29 1	25 0	27 13	24 10
Herefords —Two-year-olds...	24 9	20 11	24 12	19 13
Devons— ,,	22 18	18 3	22 15	19 7
Welsh Runts— ,,	21 8	18 8	21 2	18 8
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	57 5	49 0	56 7	48 9
Store Pigs :—				
8 to 12 weeks old	27 8	19 10	33 2	25 5
12 to 16 ,, ,, ...	47 3	35 10	52 6	40 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in November, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—						
English	1st	87 0	87 6	—	87 6	83 0
	2nd	82 0	84 0	—	80 6	80 0
Cow and Bull	1st	78 0	82 0	71 0	75 0	75 0
	2nd	73 0	74 0	62 6	70 6	68 6
Irish: Port Killed	1st	86 6	83 0	81 6	85 0	80 6
	2nd	79 6	76 6	77 0	78 6	76 6
Argentine Frozen—						
Hind Quarters	1st	—	—	—	—	—
Fore ,, ...	1st	—	—	—	—	—
Argentine Chilled—						
Hind Quarters	1st	82 0	80 6	80 6	82 0	81 0
Fore ,, ...	1st	70 0	68 6	69 6	69 0	69 6
American Chilled—						
Hind Quarters	1st	—	84 0	—	85 6	—
Fore ,, ...	1st	—	69 0	—	72 6	—
VEAL:—						
British	1st	104 6	—	—	115 6	—
	2nd	97 0	93 6	94 6	97 0	95 0
Foreign...	1st	—	—	—	—	—
MUTTON:—						
Scotch	1st	106 0	—	113 0	114 6	111 0
	2nd	102 6	—	108 0	106 6	106 6
English...	1st	108 6	114 0	—	110 0	103 6
	2nd	105 6	108 6	—	101 0	97 0
Irish: Port Killed	1st	107 6	—	100 6	102 6	103 6
	2nd	102 6	—	95 0	96 0	99 0
Argentine Frozen	1st	82 6	75 6	78 0	81 6	78 0
Australian ,, ...	1st	—	—	—	—	—
New Zealand ,, ...	1st	79 6	79 6	79 6	83 0	79 6
LAMB:—						
British	1st	—	112 0	116 6	114 6	116 6
	2nd	—	107 6	102 6	105 0	112 0
New Zealand	1st	95 6	95 6	93 6	91 0	93 6
Australian	1st	—	—	—	—	—
Argentine	1st	88 6	84 6	85 6	86 6	85 6
PORK:—						
British	1st	128 0	120 6	113 6	115 0	115 6
	2nd	120 6	111 0	103 0	101 0	104 6
Frozen	1st	97 0	96 0	95 0	95 0	96 6

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in November, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	22 6	21 6	—	—	22 6	21 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	206 6	203 0	208 0	204 0	208 0	203 6
,, Factory	189 6	181 0	188 6	182 0	191 0	185 0
Danish...	—	—	219 0	216 6	218 0	214 6
French...	—	—	—	—	195 0	190 0
Dutch	—	—	—	—	198 0	194 0
American	192 0	187 6	192 0	187 6	191 0	185 0
Canadian...	198 6	196 6	—	—	198 0	195 0
New Zealand	206 0	201 0	—	—	203 6	199 6
Argentine	—	—	—	—	203 0	198 0
CHEESE :—						
British—						
Cheddar	124 6	118 6	126 0	122 0	127 0	121 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	142 0	137 0	144 0	135 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	120 0	117 6	122 6	117 6	121 6	118 0
BACON :—						
Irish (Green)	125 0	117 6	121 0	118 0	119 6	115 6
Canadian (Green sides)	113 0	109 0	112 6	108 6	113 0	109 0
HAMS :—						
York (Dried or Smoked)	165 0	159 0	—	—	166 6	158 6
Irish (Dried or Smoked)	—	—	—	—	160 0	154 0
American (Green) (long cut)	113 0	109 0	113 6	109 6	114 0	110 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	34 7	31 8
Irish	30 6	—	29 11	28 0	32 6	30 8
Danish	—	—	—	—	33 9	31 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	236 0	220 0	186 6	176 6	240 0	224 0
Edward VII.	245 6	224 0	196 6	185 0	238 6	227 6
Up-to-Date	240 6	225 6	188 6	178 6	233 0	222 0
HAY :—						
Clover	—	—	150 0	140 0	143 0	133 6
Meadow	—	—	—	—	143 0	133 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	Wheat.			Barley.			Oats.		
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 8 ...	30 11	46 2	55 8	25 11	29 7	47 8	18 4	26 5	31 5
,, 15 ...	31 0	48 9	56 7	26 0	30 5	48 6	18 6	27 6	31 11
,, 22 ...	30 11	51 6	57 2	26 3	31 3	49 6	18 11	28 10	32 6
,, 29 ...	31 1	52 8	58 0	26 6	32 5	51 0	19 1	29 10	32 11
Feb. 5 ...	31 0	53 3	58 3	26 7	33 7	52 5	18 9	30 3	32 4
,, 12 ...	31 0	54 8	57 6	26 7	34 7	52 10	18 11	31 1	32 2
,, 19 ...	31 0	56 0	56 11	26 7	34 11	53 6	18 11	31 5	31 9
,, 26 ...	31 0	56 0	58 2	26 6	35 3	54 2	18 11	31 8	32 2
Mar. 4 ...	31 5	55 11	59 4	26 2	34 6	55 7	18 9	31 8	32 4
,, 11 ...	31 6	54 8	58 2	26 0	33 5	55 6	18 7	31 0	32 3
,, 18 ...	31 5	53 9	57 9	25 8	32 2	55 4	18 6	30 7	31 10
,, 25 ...	31 4	54 3	55 11	25 7	31 11	54 6	18 8	30 6	31 4
Apl. 1 ...	31 6	54 6	53 6	25 6	31 9	53 8	18 5	30 6	30 5
,, 8 ...	31 5	54 9	51 8	26 8	31 3	53 7	18 4	30 4	30 1
,, 15 ...	31 7	55 4	53 2	25 4	30 10	53 1	18 4	30 5	30 7
,, 22 ...	31 9	56 5	55 3	26 6	31 5	52 10	18 5	30 11	31 8
,, 29 ...	31 9	58 3	56 3	26 0	32 7	53 5	18 5	31 5	32 4
May 6 ...	32 2	60 5	55 7	25 6	33 3	53 1	18 9	32 4	32 10
,, 13 ...	32 7	61 7	55 5	26 3	34 0	53 5	18 11	32 5	33 1
,, 20 ...	33 0	62 0	55 0	25 10	34 1	52 10	19 0	32 8	33 0
,, 27 ...	33 9	61 11	54 7	26 1	34 8	52 9	19 4	32 7	33 4
June 3 ...	34 0	61 9	53 3	25 11	35 4	53 9	19 4	32 5	33 3
,, 10 ...	34 1	60 1	51 2	24 11	34 5	52 8	19 8	32 4	32 7
,, 17 ...	34 1	56 1	48 10	25 10	34 3	50 9	19 9	31 9	32 1
,, 24 ...	34 3	52 0	47 6	25 4	34 4	49 10	20 0	31 9	31 3
July 1 ...	34 4	49 5	46 3	24 6	35 3	49 1	19 9	31 1	30 10
,, 8 ...	34 2	50 1	46 3	24 9	34 7	45 6	20 0	31 6	30 8
,, 15 ...	34 1	52 7	48 11	24 2	35 8	47 5	19 10	31 6	31 6
,, 22 ...	34 0	53 10	51 6	24 7	35 10	48 8	19 9	32 1	32 3
,, 29 ...	34 2	55 3	53 5	25 9	36 1	47 2	19 8	31 1	32 5
Aug. 5 ...	34 9	55 4	55 1	25 2	35 7	46 1	19 1	31 5	32 9
,, 12 ...	40 3	55 2	56 7	29 4	37 0	46 11	25 1	31 7	31 2
,, 19 ...	38 9	54 3	58 1	29 10	39 4	48 0	24 3	31 4	30 8
,, 26 ...	36 2	51 11	59 0	30 3	38 3	47 1	23 5	30 0	31 6
Sept. 2 ...	36 5	45 3	59 4	30 6	38 1	48 5	23 9	26 10	30 5
,, 9 ...	37 10	43 0	59 3	29 11	37 11	51 7	23 11	26 8	31 1
,, 16 ...	38 3	42 9	59 11	29 5	39 0	52 6	23 8	26 4	30 9
,, 23 ...	37 6	43 3	59 4	29 3	39 8	53 3	23 3	26 1	30 9
,, 30 ...	37 1	43 5	58 10	29 1	40 4	54 1	22 9	26 5	31 1
Oct. 7 ...	36 8	44 1	59 2	28 10	41 0	54 5	22 5	26 5	30 9
,, 14 ...	36 7	45 9	59 7	28 8	42 3	53 10	22 4	27 1	31 6
,, 21 ...	37 2	48 2	60 9	28 7	44 0	53 8	22 5	28 1	31 11
,, 28 ...	37 10	50 3	62 10	28 3	46 2	54 6	23 7	29 1	32 10
Nov. 4 ...	38 8	51 6	66 7	28 6	47 3	56 2	23 7	30 4	34 0
,, 11 ...	39 8	52 8	69 8	29 0	47 5	58 0	24 8	30 11	35 8
,, 18 ...	41 0	53 6	70 9	29 8	47 11	59 8	25 5	31 3	37 8
,, 25 ...	41 11	54 2	70 8	30 3	48 7	61 8	25 8	31 1	39 7
Dec. 2 ...	42 2	53 7	71 3	30 2	48 11	63 1	25 9	30 11	41 4
,, 9 ...	42 1	52 10	72 1	29 11	47 10	68 6	25 9	30 4	44 1
,, 16 ...	42 7	53 11		29 8	47 5		25 9	30 6	
,, 23 ...	43 3	53 10		29 9	47 2		25 11	30 7	
,, 30 ...	44 4	54 9		29 10	47 5		26 6	30 10	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of November, 1914, 1915, and 1916.

—	Wheat.						Barley.						Oats.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	42	4	54	11	71	10	30	10	49	4	62	2	24	11	31	10	37	5
Norwich ...	39	10	52	7	68	3	28	9	48	3	57	11	25	3	30	7	37	0
Peterborough	40	10	53	3	69	1	30	3	49	3	59	7	25	3	30	11	36	9
Lincoln ...	40	5	53	7	68	8	29	8	48	4	59	9	25	3	30	6	37	5
Doncaster ...	40	7	52	11	67	2	29	3	44	11	57	3	24	5	30	9	35	4
Salisbury ...	40	1	52	3	71	4	29	4	48	5	60	4	24	9	31	3	36	8

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AGRICULTURE AND THE WAR.

At a meeting at the Bedford Corn Exchange, on Saturday, 6th January, 1917, Mr. W. Ell in the Chair, the Right Hon. R. E. Prothero, M.P., President of the Board of Agriculture and Fisheries, dealt with the question of increasing the output of home-grown food.

Mr. Prothero said:—Now it seems to me that I could best begin by reminding you of this fact: Farmers do not make the prices that they get for their produce. Those prices are made for them; and they are made at the present moment by the shortage of corn throughout the world, by high freights, high costs of all the materials of production, and by the great demands on our mercantile marine. For years and years past, under our present fiscal system, the nation has cared nothing where it got those supplies of food from, so long as they were cheap and plentiful—(hear, hear); and that policy has, in the past, succeeded. There was no country in the world where food was cheaper and more plentiful than in England. The more food the foreigner could sell to us, the more money he had to spend on our manufactured goods, and the factory, the furnace and the forge flourished by the ruin of English farms. (Hear, hear.)

Now, Sir, all those conditions are changed. The war has turned them upside down; and for the first time for forty years the nation is feeling the effects of its own fiscal policy, and it cries out against its necessary results. When wheat fell to 23*s.* a qr. it ruined farmers by the hundreds and the thousands; and no consumer protested. When wheat rises to 70*s.* the nation cries out for the reduction of the price. If one side of our fiscal policy has ruined the British farmer, the farmer may with some show of reason say that it is only right that he

should be enriched by the other. (Hear, hear.) There is a great deal of truth in all that; but, at the same time, I have come here to-day to say to the farmers of Bedfordshire that they must drop all that—that they must forget the injury done them in the past. It is easy enough for them to forgive, because they were the injured party. They must blot out the memory of the past; and to-day in this national crisis they must ask themselves one question, and one question only: What is my duty as a patriotic citizen in this hour of our nation's need? (Applause.) There can be but one answer; and that is, to grow all the food they can for man and beast. And if you think of it, we live here to-day in peace and security, so far as our home life is concerned, thanks to the sacrifices that men are making for us by sea and land; and the sacrifice that we ask from the farmer is small compared to that enormous sacrifice that those men are making for us to-day. (Hear, hear.) What is the sacrifice? The sacrifice is this, that they should consent to some limitation of the profits they might expect to realise in these times of war; and it is not all loss to them. There is gain to them on the other side, if we guarantee them that their losses shall be limited, as well as their profits. That is the point I want to put first—this question of prices.

Now, I do not profess to understand what is called the farmer's mind, because I have always found that farmers are individuals, just like other ordinary people, and I do not believe that there is such a thing as a collective farmer's mind. All I can do is to try and put myself in the farmer's position, with his capital and skill embarked in the industry, and ask myself what do I want at the present moment. Well, quite plainly, I should like to be left alone, free to use my own judgment to speculate on what is the most profitable crop in this or that direction. But the national necessities forbid that course; therefore there must be some general guidance given. Next to that, I suppose, I should like to have prices determined by the play of the market, as it is called; but, again, the national necessities prevent that. High prices are in one way useful, because they compel economy. But in another they are mischievous, because the man whom they compel most is the very poorest of the poor; and, putting myself again in the position of the farmer, I say I should not like to take the highest price I could get, if it means that by so doing my very poorest neighbours are to go short.

What is the Food Controller appointed for? Why, to regulate prices; and it is quite certain that when the time came he

would use his power. Therefore, I ask myself again which would I prefer: Would I like the Government to stand by and see me putting in my crops, and all the time waiting till they were harvested and delivered, and then fixing a price? Would you like that? I think not. I think the fairest and most honest course that we can pursue is to fix a price now, and ask the farmers of this country to contract with the Government at that price to raise all the food they can. That is the fair and honest thing to do; and I believe that if those prices are such as to guarantee to the farmer a reasonable profit on his skill and on his capital, he does not want a pecuniary bribe to do his duty by the nation, and to put his whole heart into raising every pound of beef, and every pound of bread he can, to meet the nation's needs. (Hear, hear.) I do not believe that the farmers are such a race of people as to want pecuniary inducements. Give them certainty, give them a reasonable profit, and as patriotic citizens they will do their best; and the men who say to the contrary (and there are such men) are, I believe, totally ignorant of what is in the minds of the farmers of the country in this great crisis. (Applause.)

Prices.—Then let us come to the question of prices. We have fixed a contract price for wheat, and we have fixed it at 60*s*. a quarter, 504 lb. to the quarter, and 63 lb. to the bushel. It is not the "Gazette" average price. Very likely ignorant people will say we are over so much than the "Gazette" average of last year; as every one of you know, that average is taken on 60 lb. to the bushel, and not on 63 lb. We fixed that price. If a man gets 4 quarters to the acre, it is a good price; if he gets 3 quarters to the acre, it will save him from loss. But I know cases, and I dare say many of you in this county know cases where, if the farmer had had in the last season 80*s*. a quarter, he would have lost money, because his yield of corn was not more than 2 quarters to the acre, on what ordinarily is good wheat land. (Hear, hear.)

Now that is what I want to guard against. I cannot prevent that gamble, which every agricultural operation is, with the weather. I cannot prevent that. But what we do offer is that price; and remember this, it is a price for the whole crop, whether it is sown in the autumn or sown in the spring, that is to be harvested in 1917. Remember that, and get it clearly in your minds, that it is the harvest of 1917, whether it is autumn or spring sown.

Now you cannot expect the Government to be so foolish as to buy damaged wheat at that price. Of course not. We are going to grade it downwards from that 60s. according to quality, just the same as to-day every man has one high price for his wheat, and it descends

by gradations according to quality. We are going to do that, and do it most carefully. We are going to have the best expert advice that we can, and we shall follow as closely as possible the sort of gradations with which you are familiar in your everyday business.

Now I should have liked, could I have done it, to have said that for any man who would keep his wheat in the stack to the end of March, there might be some additional shillings a quarter. (Hear, hear.) But—and here is my difficulty, and it is one that will come home to every one of you—we cannot tell what our necessities may be. We cannot say that we may not want that wheat before. We think we may, and therefore I am running no risks; and the Food Controller cannot offer that bonus. Of course, when the wheat is threshed and delivered, the straw is yours. I add that to make it perfectly clear; and I would add this, that so far as possible we mean to leave the farmer to thresh when he likes, at his own convenience, and in his own judgment. He alone knows the condition of his wheat in his stack, and he is the best judge. But again it may be necessary to ask him to thresh it; but that will not be done unless there is absolute necessity.

Now remember that when the wheat is produced and delivered, my functions end; and so do those of the farmers behind me. They have then no more to do with it. It then passes into the hands of the Food Controller. I cannot tell you what he is going to do, because I do not know. But let me illustrate how the thing might be worked. The dealer buys the wheat at that price, and he is entitled to a fixed commission. He sells to the miller, and the miller grinds on a fixed commission. The miller sells to the baker, and the baker bakes on a fixed commission; and so right away down from the grain to the loaf of bread. We mean it to get down to the consumer with as few intermediary profits as possible. (Applause.)

Then take the price of oats. There again we are going to take oats on a weight of 336 lb. to the quarter as our standard. I am not in a position to announce the price to you to-day; I hoped I should be; but it will be announced very early next week,* and let me say that we are going to deal with oats on precisely the same principle on which we have dealt with wheat. And there is one point I want to make clear to you: the special price for oats which has been announced is that of a contract with the War Office of 41*s.* 3*d.* for oats grown on broken-up grass land—that, and that only. Remember that. There are contracts, I believe, in the possession of the War Agricultural Committee, and if anybody likes to take up that form of contract, it is open to him; I will also say this, that though it may seem at first sight that there is a bonus on ploughing up grass land—and there is a bonus offered—it is not quite so big as it looks, because the man who grows oats is under that contract obliged to expend a certain sum in manure. I myself think that those particular clauses in the

* *See* p. 1007.

contract will have to be amended. I think (and I believe our friend, Mr. Eve, who is the Controller of that side of the subject under me, agrees with me) that to compel a man to spend a certain sum on manure on grass land which he has ploughed up, is to run the risk of having his crops laid, because really the manure is not wanted; and if that grass land has been properly treated in the past, and if cake has been fed upon it, or anything of that sort, the land is fertilised sufficiently to grow the crop. As I say, those contracts are open to any one of you to inspect, and if you like to enter into a contract with the War Office, it is open to you to do so; but the Government price will be fixed for oats on a basis of 336 lb. to the quarter, and not, as Mr. Eve's price is based, on 320 lb. to the quarter.

Now, we propose to deal again in precisely the same way with potatoes. Potatoes are the crop which produce the maximum of food probably to the acre, and we want largely to increase the amount of potatoes grown on our land. I regret more than I can say that I do not occupy this position in times of peace, because I believe that in the potato crop we have a wonderful source of potential agricultural wealth for this country. (Hear, hear.) Out of the potato—and by this of course you save all the loss which makes the crop a hazardous one to-day—you can get commercial alcohol, invaluable as a motive power; you can get potato meal, which keeps for a long time, and which can be sent about the country in a compact form; and you get various other by-products, such as dextrine. Then you also get considerable quantities of glucose. You get pure albumen; you get an invaluable food for cattle from the refuse, and you get one of the richest fertilisers for sandy soil that can be imagined. But you want the machinery, and you want the buildings; and you cannot set them up to-day. But, in my opinion, when peace comes, that is one of the industries I want to see created in this country. (Applause.) It has this great advantage: that it is a rural industry which is busy for six months in the year, and for the rest of the time there is an abundant scope for the men employed in it on the land.

Referring to the price of barley, Mr. Prothero said that that was a difficult question, and he left it unsettled.

Fertilisers and Feeding Stuffs.—Proceeding, Mr. Prothero said:—Now let me say a few words, and only a few words, on seeds, fertilisers, feeding stuffs, and labour. First of all, as to seeds. Most farmers have got their seeds already, I have no doubt; but at the same time I want

to assure them that we are keeping our eye on seeds, especially those of spring wheat, and seed potatoes. I only tell you that, because I want farmers to understand that we are not forgetful of that side.

Then, take fertilisers. There are three fertilisers, or two fertilisers and one other material, which are home produced: they are sulphate of ammonia, basic slag, and for the other material, sulphate of copper. I am coming to that afterwards. Sulphate of ammonia is one of our few home-produced manures. We have prohibited its export, and we have withdrawn the licences for its export—(hear, hear)—except as to a limited quantity for our Overseas Dominions. Remember, they are growing food for us. We hope that there will be enough sulphate of ammonia to go round. But the war requirements are very large, and we shall have perhaps to be very economical in its use. At all events, we have got that matter in hand; and you may rely upon it that if we can, we shall provide for all the requirements of sulphate of ammonia.

Then, take basic slag. There are heaps of basic slag in this country, but there are not plenty of men to grind it. We are now using every effort to get the men to grind it, and I have no doubt whatever that we shall get them, and that there will be plenty of basic slag for your use. Sulphate of copper is useful in this way: if we get a third wet season, we may have a considerable outbreak of potato disease, and the best known remedy against that disease is spraying with sulphate of copper. We have estimated the probable quantities, and we are making arrangements as far as we can, and as far as it is within our powers, to supply potato growers with sufficient sulphate of copper to spray their potatoes twice, and I warn you of this, that if we get enough, we should probably make that twice spraying compulsory.

Now there are two other fertilisers, one of which is potash. I am sorry to say we cannot promise you any potash. Then, superphosphates. . . . . . . I hope that by careful management we shall gradually increase the supply of superphosphates. What we find happening is this: one manure manufacturer has got sulphuric acid and no phosphatic rock, and another at the far end of the country has got phosphatic rock and no sulphuric acid; and the first thing that we are trying to do is to bring together the sulphuric acid and the phosphatic rock in quantities in the same hands.

Now comes the question of feeding stuffs. That, to my mind, is one of the most urgent, if not almost the most urgent, question that we have to face. (Applause.) But once again let me remind you of this: very nearly all our feeding stuffs are brought in from abroad. There may be warehouses at Rangoon bursting with rice meal, but the difficulty is to get it to this country; and so it is that our feeding stuffs, our linseed, and various oil cakes, have gone up in price. That is a question for the Food Controller. My own view in dealing with this question is this: those oil-cake and feeding-stuff makers are making profits; the right thing is to see that the men who want these excessive profits should not make them, and the men who want the feeding stuffs to keep their live stock alive should be able to get them at cheaper rates. (Hear, hear.) I cannot tell you what is going to happen, but I can assure you once again that that is a point on which you will very shortly hear something more. (Hear, hear.)

Labour.—Now we come to the greatest question of all, the question of labour. I should like to say this, that you will never have a more persistent, painstaking, energetic champion of your claims to labour with the War Office than my predecessor, Lord Crawford. I have seen the correspondence, and I think that no stone was unturned to get you the labour, and he did get you two valuable concessions: one was the limit of time, and the other was the question of substitution. Of course, when we speak of substitution, we every one of us know where that scheme fails. If farmer A. has given up a man and taken a substitute in exchange, there is nothing in the world to prevent that substitute going off next week to work for farmer B., who has not given up a man at all. We are alive to the point, and we may be able to deal with it. I hope we shall. (Hear, hear.)

Now I have found at headquarters that the War Office are genuinely anxious to help in every possible way, and I am sure they will do it, and are doing it in every possible way; but, as you may imagine, there are grave difficulties in the way. What they have promised me is this: that until the census returns are fully in and are carefully analysed, they will make no further call for men; and, further than that, I have submitted to them, and I hope something may come of it, a plan by which, instead of a large number of men being hauled up before local tribunals and appeal tribunals, and kept waiting for days at a time when labour is absolutely necessary, that at the least some plan shall be devised by which only the men about whom there is any difficulty shall be sent for to go before the local tribunal. (Applause.) I hope it may succeed. Further than that, the War Office have agreed that where a farmer has the agreed amount of male labour on his farm, it will not matter how many women he has to work for him; they are only supplementary, and do not in any way imperil his male labour. (Hear, hear.) I think that is a big point. For my own part I believe that, among various other causes, the fear of the farmer is that if he took women on his land, the military representative would say, "You do not want your man now, I am going to have him," and that prevented farmers from employing women. That no longer exists. Then they have promised to give us back—and we have to trace them—the men who were employed on steam cultivators and steam tackle. (Applause.) That is a matter which is going forward rapidly, and I hope it will be successfully dealt with before long. Field-Marshal Lord French has promised to help us in every way. I want to be very careful about what I am going to say on this point, and, therefore, I am going to read one or two important sentences. "In the first place the Field-Marshal cannot release men under training, nor men required for necessary military duties. He also wants ample notice of the approximate number of soldiers that are likely to be required in any district. Commanding Officers have been directed, where there is any difficulty in supplying labour from their own district, to make application to headquarters, when every effort will be made to move troops to meet all reasonable demands." We may anticipate not less a number than 20,000 soldiers spread over

the country. Of course there are unreasonable soldiers, and sometimes your soldier labour has disappointed you. But may I point out that there are also sometimes unreasonable farmers. (Laughter.) Then we have also got all the German prisoners, and as many of the interned aliens as we could, who are skilled in agricultural work, and we propose to allot them to the counties; and especially, of course, to those counties where the largest arable area is under cultivation. We have also got a considerable number of conscientious objectors, and we may anticipate some numbers of men from Mr. Neville Chamberlain's Man-Power operations.

Then I come to the point of women. We have already got something like 100,000 women; we hope to get 100,000 more. These are almost entirely local women. The Women's War Agricultural Committees have done most admirable work in getting those women; and I want to urge them as strongly as I can to do what the Men's War Agricultural Committees are doing, to get right down to the parishes, and see that there are no blanks, no parishes where no one is working. I had intended—and I had gone half-way towards it—to form a Department at the Board of Agriculture to deal with this great question of women, and I have got a skeleton organisation. I also had another scheme. There are a number of women living in some degree of luxury in our towns, women who are looking out for some form of work. If I went to those women and said "I have some hard, monotonous work for you to do, the pay is small, the lodgings are probably uncomfortable, will you come out?" They would say, "Thank you; I would rather look out for some work which I think I could do better." But—and this is the plan I wanted to see adopted—if I could go to those women and say to them, "You will be voluntarily enlisted into the supply army; you will get 1s. a day, and a billeting allowance, like your brothers in the trenches, and you can share what they are doing, and share their sacrifices," they would have come out by the thousands. (Hear, hear.)

Now that power of billeting would also remove one of the greatest difficulties. I know enough of domestic households to know this, that if a farmer brings into his house a woman who is working on the land as a paid labourer, the chances are that his servant would refuse to wait upon her. But bring into his house a woman who is billeted there, and who is sharing in her own way all the sacrifices of her brothers in the trenches, and that difficulty would disappear. I had that plan, and I have that department in my mind. But the appointment of Mr. Neville Chamberlain necessarily compels me to hold my hand there, because his powers include the women on the land. I have no doubt whatever that we shall work happily together; but I do hope that he will remember that women want something like two months' training before they are of much use, and that if he does not look sharp, the spring sowing will be over before he gets his women on the land. (Applause.)

Machinery.—Then I come to the question of machinery. If you cannot get all the labour you want, the next best thing is to get all the machinery you want. We have got powers to order a very considerable number of machines from America, and they will begin to arrive

in this country very shortly. The pattern will be the Mogul pattern, which in my opinion is the best of the American patterns. They will begin shortly to arrive in this country; and I have got arrangements made by which they will be kept in repair, and manned by drivers whom we are now specially training in schools which we have opened for their use, and they will be placed in certain numbers at the disposal of the War Agricultural Committees. (Hear, hear.) They will not only be manned and repaired, but they will be supplied with the necessary lubricants, with the paraffin and the petrol that are required. They will come in very considerable numbers, as I hope; and, as I say, they will begin at once.

I am afraid that that is all I can say to you on the question of labour. I believe that we shall succeed in considerably alleviating the position. But we must remember this: we have lost one-third of our men, and we cannot supply that want; therefore we must do the best we possibly can with such material as is before us. All this I have been describing to you is essentially a farmers' movement; the farmer can do it far better than anyone else. He has the energy and he has the experience, and, provided that we give him every assistance, I am perfectly sure he is ready to set to work; and I congratulate this county and Mr. Ell, as Chairman of the War Agricultural Committee, on the admirable way in which they have worked out the plan for the future campaign. Now it rests with me to say "Go!" and I have to say, "Go, with the compulsory powers behind you. Go on land which is derelict, land which is improperly cultivated, and carry out this work of increasing the production to the utmost." We will send the Order in Council down as soon as it is passed; but I am authorised to say this; that there is no reason for you to wait. (Hear, hear.) The Order in Council will be retrospective as from the 1st of January, and it will cover every illegal act, or act which would have been illegal before the Order was passed.

Now, why do I say that farmers can do this work best? I say it for many reasons; but I say it for one in particular, and it is this: Where the land is least properly cultivated you can generally trace it to two causes; one, want of capital, and the other, want of energy. If a farmer who has done well in farming, a man who is known as a successful farmer, goes to the tenant of one of those uncultivated farms, and with all the strength of his experience tells him what he ought to do, the tenant is far more likely, in fact, ten times more likely, to listen to him than he is to any number of officials or any number of persons like myself. (Hear, hear.) I say, try and get the men themselves to do it. You do not set out to catch a colt by hanging the halter in front of you and the sieve behind your back. That is the way I want you to deal with your compulsory powers—put the sieve out; tell him what he can do with his land, how he can improve his own position, and do not bring out your compulsory powers till the last moment. But you have got them; and if you find you must use them, then use them quite ruthlessly.

Grass Land.—There is one other point of detail which I should like to mention, and that is the question of grass land. "The

liability of a tenant to his landlord for breaking up grass land is generally settled by the terms of his lease. But if his lease does not specifically deal with the question, then he is only liable if the breaking up of grass land is held to be a breach of the implied covenant for husbandlike cultivation. There is no breach of that implied covenant unless the land is meadow or well established pasture; and even when it is well established pasture, there is no breach if that pasture was arable at the commencement of the tenant's occupation." When you come to the leases, then covenants are of various sorts. There is a covenant not to break up certain specified lands; there is a covenant not to break up land which at the commencement of the tenancy or during the tenancy shall be in park land. Now both of those are covered completely by this Order. Provided that you carry out the instructions in my circular to you, any tenant who ploughs up land under either of those covenants is safe.

Then there are two other covenants; there is the covenant to leave a certain fixed area in pasture at the end of the tenancy; and there is the covenant to pay additional rent as compensation if pasture is broken up. Those two covenants are not covered by our Order. They are not covered by it, because it will mean actual legislation. But provided you break up the land on an express direction from the Board of Agriculture to do it, even in those two cases the Board will stand by you and see you indemnified.

With regard to the risks of the future in connection with ploughing up grass land, Mr. Prothero expressed his firm and strong conviction that no great and far-reaching measure of ploughing up grass land can ever be carried in this country unless the farmer has a guarantee for at least eight or ten years. (Applause.) Supposing the war ended, and supposing all the foreign nations resumed their ordinary methods of life, these big exporting countries which have expanded their area to meet the wants of belligerent nations will have only this country into which to throw their produce; and if that is the case, if we as a nation will not safeguard the farmer against the risk of once more, as in the '80s and '90s, losing his capital through foreign competition—if the nation refuses to safeguard him in that respect, Mr. Prothero could not see any reason why the farmer, however patriotic he is, should run that tremendous risk. If the nation, for the nation's security, knowing what it does now of the danger of leaving us a country with scanty supplies of home food—if, knowing all that, it determines to revert to the old state of things, it is the nation's doing, and it is the nation's undoing, too. (Applause.)

Small Producers.—Turning next to the smaller producers, Mr. Prothero continued: We have already empowered district urban centres to take possession of vacant lands, and to cultivate them or to hand them over, in allotments if they like,

to persons who will grow on them their own vegetables. Lord Rhondda and I, the President of the Local Government Board and the President of the Board of Agriculture, have suspended the by-law, or, to put it rightly, asked the Urban Councils to suspend their by-laws, against keeping pigs in the rural districts comprised within their areas. That Order has gone out; and I hope it will be carried out with such provisions for the clean and wholesome condition of the styes as will make it no nuisance. In almost all rural districts there is no by-law in existence which prevents anybody from keeping a pig. That being so, I want to have formed, either in the neighbourhood of towns or in rural villages, clubs, or if you like, groups of persons who will grow potatoes and keep pigs; and I have got the permission of the Treasury to do this, or rather I should not say I have yet, but I hope to get it, a very important point, but, as Sir Arthur Black on my right says, I shall get it. (Hear, hear.) I want to get the Treasury to allow us to advance money to those groups to buy pigs or buy seed potatoes, and ask them only for a deposit, and hold that deposit, and ask them for the rest when they get their crop in. (Hear, hear.)

We have also got a scheme in hand to cultivate the land round our great collieries. If any of you have travelled in either France or Belgium, you may have been astonished at what those frugal, thrifty men grow, right up to the pit itself. We hope to do that. I may mention that in that matter I have behind me the support, and warm support, of one of the greatest colliery owners in Wales—Lord Rhondda. (Hear, hear.) Then, again, we are approaching all the railway companies in this country to utilise their embankments and all their spare land. I am not going to ask them, and nothing will induce me to ask them, to allow strangers who are not familiar with railways to go on that land; that would be absurd. But we are going to ask them to put them at the disposal of the men who are working on the lines—men who know the dangers and can cope with them.

Children's Work.—Finally (and it is a very small thing, but sentiment goes a long way), I want to enlist the services of the children in our village schools. Our village gardens are 800 acres all told; but I hope the new Minister of Education will shortly issue a sort of direction to the schoolmasters that the children in the schools are to use those gardens to grow potatoes and cabbages in their time of need. I am an old man; but still I remember when I was a child the pleasure and delight it was to me to be told to do something useful. I believe in your villages it is just the same; and that those children, when they grow to be grandparents, will tell their grandchildren how in the great war they did their bit by growing potatoes and cabbages. (Applause.)

Now as to all this small side thing, I can quite imagine the War Agricultural Committee, so far as it consists of farmers, must find its hands full; and I would suggest to them very respectfully, because I regard it as their own work, that they should find someone whom they can co-opt on to their Committee, who will take the smaller side off their hands. They can use the Women's War Agricultural Committees, because we want those Women's War Agricultural Committees to do as the Men's Committees are doing, get right down to every parish. That is one way in which they could use them. There are other ways according to different counties. There are lots of men who give their whole time service to such work, and the War Agricultural Committee can command them; because I am sure of this, that everyone in this county is anxious to press forward this great movement to a successful issue. (Hear, hear.)

ADULTERATION OF WHITE CLOVER SEED.

T. ANDERSON, M.A., B.SC.,

Director of the Seed Testing Station for Scotland.

DURING the spring and summer of 1916, numerous instances of the adulteration of White Clover Seed were found in samples sent by farmers to the Seed Testing Station of the Board of Agriculture for Scotland. As soon as the occurrence of adulterated stocks on the retail market was verified, a warning to farmers was published in the Press by the Board, and this public notice resulted in a considerable number of doubtful samples being submitted by farmers for analysis.

The following account of the methods of adulteration known to have been practised during the past season by unscrupulous dealers is intended to amplify the warning thus given, and to prevent the recurrence of similar frauds in future years by impressing on farmers and retail merchants the very great depreciation in the value of seed which adulteration may effect.

The supply of white clover seed in the season 1915-16 was short, and the price of the seed was consequently very high. The inducement thus offered to increase profits by adding cheap and inferior material to stocks was great. That adulterated stocks were common may be assumed from the fact that 15 per cent. of the total samples received at the Seed Testing Station from farmers were found to have been adulterated with the seeds of other clovers.

Forms of Adulteration.—The methods of adulteration practised usually took the form of the addition of seeds which occur as natural impurities in white clover seed, *e.g.* (1) Red Clover seed, added in the form of screenings, and (2) Seed of Suckling Clover. Another form of deception which cannot properly be called adulteration, but which comes in the category of methods of partially substituting worthless for useful material, was the addition to new season's stock of (3) old White Clover seed.

1. *The Addition of Red Clover Screenings.*—This form of adulteration was verified in no less than 10 per cent. of the total number of samples submitted by farmers for analysis.

The screenings used for the purposes of this deception were chiefly those of the light-coloured Chilian and Italian red clovers, of which the small seeds are similar in size and colour to the seeds of white clover and are not readily noticeable in white clover in bulk, although their presence is easily detected on careful examination.

The following details of a typical analysis give some indication of the extent of this particular form of adulteration :—

A.—Sample No. 845, described as White Clover, consisted of :—

White clover	77·0 per cent.	=100 per cent.
Red clover (whole seeds)	8·1 ,,	
,, (broken ,,)	4·2 ,,	
Other clovers	2·7 ,,	
Clover dodder	0·5 ,,	
Weeds, sand, etc.	7·5 ,,	

The germinating capacity of this sample was 77 + 14 hard seeds per cent.

The evidence of adulteration of this sample (*A*) is to be found in the large percentage of red clover seed present, the small size of these seeds, the occurrence of a great quantity of broken portions of red clover seed, the inclusion of a large amount of dodder, and the high percentage of other weed seeds. All this points to the use of screenings for the purpose of admixture. Red clover seed occurs as a normal impurity

in white clover seed in variable proportion, but not naturally as 12 per cent. of impurity in the form of small seeds and chips.

Clover dodder occurs as an impurity in white clover seed of Continental origin, but infrequently in any high ratio. The influence of the occurrence of dodder on the marketable value of white clover seed can be judged from the fact that, on the Continental market, white clover seed containing 10 seeds of dodder to the pound is regarded as dodder-infested, whilst seed containing 90 seeds of dodder to the pound is excluded from importation into the United States of America as being unfit for seeding purposes.

In the sample (*A*) quoted above, the number of seeds of dodder occurring in 1 lb. of the seed is approximately 8,150. This is, of course, due to the fact that they have been intentionally added along with the red clover siftings of which they were a part. The actual amount of other weed seeds added is naturally indeterminable, but, judging from the amount of dodder added, other weeds were also present in the screenings in very considerable quantity.

For purposes of comparison with the above, and to illustrate the amount of depreciation effected by the addition of worthless seeds, the following details regarding the quality of an average sample of genuine white clover seed may be cited :—

B.—Sample No. 542 (Genuine White Clover) was composed of :—

White clover	95·5 per cent.	=100 per cent.
Other clovers (including red and suckling clovers)	1·7 ,,	
Weed seeds, etc.	2·8 ,,	

The germinating capacity of this sample was 95+1 hard seed per cent.

The retail price at which the genuine seed described under (*B*) was sold was 2*s.* 1*d.* per lb. Taking this as a fair representative basis of value, the worth of the good seed contained in the adulterated bulk described under (*A*) was, at its highest limit, not more than 1*s.* 8*d.* per lb.

This estimate does not take into consideration the reduction in value brought about by the addition of material, not only worthless in itself but actually harmful, in the shape of weed seeds, the estimated number of which, in 1 lb. of the seed, reaches the high figure of 40,770, of which 8,150 are seeds of dodder as stated above. It should also be realised that the red clover seeds introduced are mostly immature, and do not germinate readily, and may therefore be considered practically worthless.

A further example of the same form of deception is quoted immediately below :—

C.—Sample No. 689, described as Wild White Clover, was found to consist of :—

White clover	82·4 per cent.	= 100 per cent.
Red clover	6·0 ,,	
Other clovers	4·1 ,,	
Grass seeds	1·8 ,,	
Weeds (including Chilian dodder), sand, etc.	5·7 ,,	

The evidence shows that the seed from which this sample (*C*) was taken had been adulterated with screenings of Chilian red clover. The red clover seeds are of small size and light colour, and include numerous seeds chipped in the process of screening. The occurrence of Chilian dodder, which is commonly found in Chilian red clover, but never in white clover as a natural impurity, confirms the fact of intentional admixture of siftings.

The partial substitution of worthless screenings for seed that was offered as wild white clover, the ruling price of which was then over 15*s.* per lb., is a particularly glaring instance of unscrupulous methods of adulteration.

2. *The Addition of Seed of Suckling Clover.*—This is a form of adulteration commonly practised. The seed of suckling clover occurs as a natural impurity in white clover seed, but in small amount, which in average good samples is quite inappreciable.

The plant may be regarded as little better than a weed, as it is quite useless in substitution for white clover for the production of good grazings.

The undernoted example shows how far this substitution may be carried :—

D.—Sample No. 668, described as White Clover, was found to consist of :—

White clover	68·9 per cent.	= 100 per cent.
Suckling clover	24·6 ,,	
Other clovers	1·0 ,,	
Weeds, sand, etc.	5·5 ,,	

The germinating capacity of this sample was 80+4 hard seeds per cent.

Comparison of the analysis of this sample should be made with that of the average genuine sample cited under (*B*), p. 942, when it will be seen that in all probability some 25 to 30 lb. of worthless seed have been added to every 100 lb. of genuine seed in the case of (*D*).

A comparison of values indicates that the white clover seed contained in 1 lb. of bulk like sample (*D*) is worth not more than 1*s.* 6*d.*

3. *The Addition of Old White Clover Seed.*—The introduction into fresh seed of old seed containing a large percentage of dead seeds is another method of making up bulk. When this has been done, the bulk is characterised by an undue ratio of black or dark brown seeds throughout, and can be thus readily distinguished from seed wholly fresh. Not only are the dead seeds valueless, but in old seed a large percentage of the bulk, even though apparently fresh, is of feeble vitality and incapable of producing a healthy plant. In one sample received by the Board during the season from a farmer, the dead seeds reached the unusual proportion of 22 per cent.

Safeguards against Adulteration.—Farmers in Scotland can safeguard themselves against frauds similar to those described above by making it a yearly practice to submit, to the Board's Seed Testing Station, samples of the seeds they propose to sow. Reports are furnished for a fee of 3*d.* per sample, payable in advance.

By far the most satisfactory way of purchasing seeds is to obtain a small sample before buying, and submit it for analysis. A preliminary report on purity and on energy of germination can be obtained within a week of the receipt of the sample at the Board's station, if a request for a report of this nature is made when the sample is sent. This report is sufficient to determine the quality of the seed. After the seed is delivered a sample should be drawn from the bulk, and submitted for analysis, in order to obtain confirmation that the seed delivered is of the same quality as the preliminary sample. Buying seed on a guarantee of purity and germination is not an entirely satisfactory method of purchase, unless the guarantee is supported by the result of the analysis of samples submitted to the Board. Guarantees may be of such a nature that they do not indicate with any accuracy the true quality of the seed they purport to specify. General information regarding methods of testing seeds may be obtained in Leaflet No. 32 of the Board of Agriculture for Scotland. This Leaflet may be obtained, free of charge and post free, on application to the Secretary of the Board, 29, St. Andrew Square, Edinburgh.

THE POSITION OF THE GERMAN STOCK FEEDER.*

Numbers of Live Stock.—There have been several official censuses of live stock in Germany during the War, the results of which are compared with pre-war figures in the following table :—

—	Sept. 1st, 1916.	April 15th, 1916.	Dec. 1st, 1915.	Dec. 1st, 1914.	Dec. 1st, 1913.	Dec. 1st, 1912.
Cattle :						
Calves up to 3 months.	1,982,891	1,974,434	1,396,767	2,069,802	—	—
Young cattle, 3 months to 2 yrs.	6,307,504	6,029,718	6,457,093	6,858,139	—	—
Bulls and Oxen over 2 yrs.	1,451,122	1,365,877	1,493,079	1,579,850	—	—
Cows and Heifers over 2 yrs.	10,597,433	10,552,154	10,970,009	11,320,992	—	—
Total ..	20,338,950	19,922,183	20,316,948	21,828,783	20,994,344	20,182,021
Sheep and Lambs	—	—	5,073,478	5,471,468	5,520,837	5,803,445
Goats	—	—	3,438,296	3,538,414	3,548,384	3,410,396
					June 2nd, 1914.	June 2nd, 1913.
Pigs :						
Under 6 months	11,204,976	9,055,382	9,587,290	14,695,331	16,906,068	14,735,845
6 to 12 months	4,230,890	2,857,041	5,346,727	7,701,905	6,123,115	5,131,718
Over 12 months	1,825,242	1,424,779	2,353,194	2,944,036	2,276,518	1,953,890
Total ..	17,261,108	13,337,202	17,287,211	25,341,272	25,305,701	21,821,453

The figures obtained at the two censuses of 1916, even if accepted at their face value, are not comparable with those given for previous years, since live-stock statistics are vitally affected by a change in the date on which they are taken. Pork in pre-war times formed about 62 per cent. of the German meat supply, as compared with 35 per cent. in the case of beef and 3 per cent. in the case of mutton. It will be seen that the numbers of pigs dropped from 25 million on 1st December, 1914 and 1913, to 17 million on 1st December, 1915. With regard to the 1916 figures, the fact that only 11 million pigs were born (and survived) between April and September, as against 9 million from the six winter months, probably represents a further decline in pig-breeding and not an increase as appears superficially (unless in normal times nearly as many pigs are born in winter as in summer). The normal number of pigs born (and surviving) in summer and autumn before the War was about 15 million, but if more pigs are born in spring than in autumn the figures in the above table represent a big decline in pig-breeding. Further, the stock of pigs on 1st December will probably be below that of 1st September. It is doubtful, therefore, whether there has been the recovery in

* **Based on a Memorandum by the War Trade Intelligence Department.**

breeding which appears from the figures of 1st September, 1916. This contention is supported by the curtailment of meat consumption during 1916.

The position has been intensified as a result of the blockade; in pre-war years the cattle and pigs imported into Germany represented about 8 per cent. of the consumption.

Great efforts have been made to encourage goat and rabbit keeping, but goats' and rabbits' meat have purposely been left outside the German Government's rationing system, and the supply cannot, therefore, be made to have an effect on the slaughtering of other classes of live stock.

The Supply of Fodder.—At the outbreak of war Germany was producing nine-tenths of the food and fodder usually required. Any curtailment of the supplies imported was likely to fall heavily on stock-feeders, since with a shortage of food it was more likely for animal foodstuffs to be converted to use by human beings than *vice versâ.*

Germany's fodder imports in 1913 were:—

	Tonnes of 2,204 lb.
1. Grains poor in albuminoids (fodder barley, maize, dari, &c.)	3,999,583
2. Grains rich in albuminoids	70,000
3. Fodders rich in albuminoids and to some extent in fats (malt germs, rice residues, bran, oil cake, &c.)	2,348,689
4. Fodders made from imported raw materials, which are used to the extent of one-half to two-thirds of their bulk, and about one-half of their value, for conversion into fodder (linseed, poppy, rape seed, palm kernels, cotton seed, soya beans, ground nuts, &c.)	1,000,000
	7,418,272

(Taken from Hoesch, *Die Wirtschaftlichen Fragen der Zeit,* Berlin, 1916.)

A writer in the *Berliner Tageblatt* of 18th August, 1916, estimated the production of meat, milk and fat made possible by these imports at 75 kilog. per household of five persons per annum as against a figure of 40 kilog. for normal imports of animal food. (This compares with an average estimated meat consumption before the War of 52·3 kilog. per *person* per annum and a present urban civilian consumption of about 13 kilog. per *person* per annum). The extent to which Germany depended for meat on foreign fodder thus greatly exceeded her actual import of animal food. It is noticeable

that more than half the fodder imports are of concentrated feeding stuffs.

To the deficiency of fodder imports and the likelihood of animal foods being further depleted to supply human needs were added in 1914 and 1915 lower harvests than in 1913. The following are official figures (tonnes of 2,204 lb.) :—

—	1915.	1914.	1913.	1912.	1911.
Wheat ..	3,855,841	3,971,995	4,655,956	4,360,624	4,066,335
Rye	9,152,402	10,426,718	12,222,394	11,598,289	10,866,116
Total bread grain	13,008,243	14,398,713	16,878,350	15,958,913	14,932,451
Oats	5,986,034	9,038,185	9,713,965	8,520,183	7,704,101
Summer barley	2,483,752	3,137,983	3,673,254	3,481,974	3,159,915
Clover	7,731,822	10,949,223	11,183,197	?	?
Meadow hay ..	24,000,000	29,156,024	29,184,994	27,681,860	19,975,324
Potatoes ..	53,979,258	45,569,559	54,121,146	50,209,466	34,374,225

The shortage of fodder became extremely acute during the winter of 1915–16. It was necessary to confine the use of oats and barley to horses and breeding stock and to forbid the feeding to animals of wheat and rye, while the enforcement of an exceptionally high percentage of milling for flour reduced the supply of bran.

As regards the 1916 harvest, it seems probable that, apart from potatoes,* there will be more grass, roots and grain than in 1915–16, though not as much as in an average year. The restrictions on the use of grain remain as severe as in 1915. Last summer and winter an enormous quantity of sugar was used for fodder in various forms. For the coming season the use of sugar-beet and refined sugar for this purpose is prohibited, and sugar and its by-products (except the slices) will hardly be available at all for the stock farmer except as an ingredient in Government patent fodders. Government control of the distribution of fodder (except green fodder, roots, hay and straw) was rendered absolutely exhaustive by Orders of 5th October, 1916. The native output of all important concentrated foods was brought under control on 28th June, 1915, and of imports on 28th January, 1916. Finally, the breakdown of the supply of eating potatoes and the comparative failure of the 1916 crop has led, since April, to severe restrictions on the feeding of potatoes to animals, culminating on 14th October, 1916, in practically a total prohibition of their use, a prohibition which is likely to be maintained during the present winter. Enormous efforts have been made to develop substitutes for oil cake,† but it does not seem that their production

* It is now officially estimated that the potato crop is only half the normal (20–25 million tonnes).

† e.g., Mineral yeast, straw concentrate, heather meal, reed-grass meal, gelatine concentrate, Scheidemandel albuminoid substitute, animal carcass meal, blood and meat meals, edible mussel fodder, and wood fodder.

can be such as materially to relieve the situation; many can only be used in small quantity in the ration, require cautious use, and are regarded with suspicion by German farmers.

Condition of Animals.—The depletion of the fodder supplies must have had an effect on the condition of the live stock. Thus a Prussian Decree of May, 1916, refers to animals as having mostly starved during the winter and as nowhere satisfying the qualities normally required in slaughter animals; and the War Food Minister, in an interview with the *Berliner Tageblatt* (25th June, 1916), said: "The present shortage of meat is due to the almost total fodder famine; the animals must literally have starved through the winter." The local authorities were complaining bitterly in June and July of the poor quality of the animals supplied to them by the cattle trade combines (see later) and were actually obliged to feed them up before killing them, a course which they were officially advised to take. Bavarian large towns were still complaining of light weight in September. In July the Brandenburg Combine remarked that there were hardly any cattle of the weight class for which the highest maximum prices were fixed. At the beginning of August it was reported that delivery to the large towns of pigs fattened on Government fodder was everywhere in arrears, and in one province would be delayed by two or three months owing to the impossibility of bringing the animals up to the prescribed weight (225 lb.).

It was the same with the milk and fat supply. Instead of improving with the advent of green feeding and the growth of stock, the milk supply was very bad all the summer; and in November, 1916, reached such a pitch that persons above the age of six, except invalids and mothers, were cut off from the use of unskimmed milk. Butter, margarine and lard have been very scarce.

The *Deutsche Landw. Presse* thought that the cattle had not recovered in autumn from the bad effects of the preceding winter: "It must not be forgotten that such a 'starving' permanently reduces the capacity of the stock to produce milk and meat, and that, therefore, having regard especially to the existing great shortage of concentrated fodder, consumers must continue to be prepared for shortage of milk, butter and meat. An increase of slaughtering at this moment, when the stock is just beginning to recover, would have the most fatal consequences."

It seems doubtful whether live stock can be brought through the present winter without serious further loss of condition,

and in any case there is little doubt that there will be considerable shortage of animals fit for slaughter for some months ahead.

Restrictions on Slaughtering.—The present civilian meat ration fixed by the German Government is one-quarter that of the normal, while a fair estimate of the army consumption is half as much again as the normal. On the assumption that the army forms one-tenth of the population, this would give a total consumption for the nation of about 38 per cent. of the normal. This figure is probably an exceptionally low one to apply to the slaughter of animals as compared with normal times.

The President of the Imperial Meat Office announced in June, 1916, that the slaughtering of cattle had been brought down to the number of normal years. Judging by the supplies of animals at the Berlin Slaughter Market, this position had not been reached in February, 1916, though at that time the supplies of pigs (forming about 62 per cent. of the meat supply in pre-war times) had sunk to one-sixth of the normal. The following are the returns :—

Supplies of Animals at Berlin Slaughter Market.

——	Cattle.	Calves.	Sheep.	Pigs.
January, 1914 ..	21,097	?	45,594	122,735
January, 1915 ..	27,240	?	40,986	171,152
December, 1915 ..	47,854	15,561	43,523	53,910
January, 1916 ..	42,394	12,367	36,378	40,339
February, 1916 ..	31,516	10,512	33,035	21,116

The large pig supplies shown in the above table for January, 1915, were part of the panic slaughtering of January to March, 1915, due to mistaken ideas of the potato supply. The ensuing smaller supplies of pigs led to the abnormal supplies of cattle.

The Government have sought to exercise an increasingly tightening control over slaughtering. In September, October and November, 1914, the killing of calves under 75 kilog. (165 lb.) and cows under 7 years was prohibited, and the States were empowered to restrict pig killing. Similar restrictions upon slaughtering of animals of different ages and kinds have since been imposed from time to time.

The public demanded in 1915 that the Government should take over the meat supply as it had done the bread supply. The Government rejected this demand in 1915 as impossible of execution, but in 1916 it has gradually given effect to it,

being probably actuated to a large extent by the wish to create a machinery which would permit it to reduce slaughtering to the very minimum, and it is in this direction that its measures have developed.

The buying of meat for slaughter has passed completely into the hands of the bureaucracy throughout Germany; this has been accomplished by the establishment of State Meat Offices and compulsory combines, given a monopoly of the meat trade, and federated in Prussia under a Central Cattle Trade Combine; to the latter other States not possessing meat offices have subordinated their combines. The dealers have sunk to the position of mere agents buying and selling solely on account of the combines or meat offices. The system was perfected by the foundation of the Imperial Meat Office, which has since fixed the number of animals which may be killed for meat in each State, leaving it to the State authorities to determine the distribution of "slaughtering quota" among provinces and districts. The period of drastic control of slaughtering in Germany dates from April, 1916.

There remains the question of the slaughtering by the farmer himself for domestic use or sale to neighbours. The South German States commenced to prohibit or restrict such slaughtering in February, 1916. Meat privately killed for sale came under the control of the Imperial Meat Office on its creation, and was to be counted towards the local slaughtering quota; and in April, 1916, the Prussian Government directed the provincial Presidents to prohibit private killing altogether. The prohibitions have since been cancelled, subject to certain safeguards.

If the fodder supply this winter is not better than last some alteration may be made in the Government's policy. A considerable body of German opinion holds that it was a mistake to feed so large a head of stock last winter, as the animals could not be properly nourished, and that this winter the present controlled rate of slaughtering should be increased so as to reduce the number of animals to be fed. The failure of the potato crop is a new element in the situation, and on the whole it is doubtful if the present live stock, especially pigs, can be brought through the winter without depletion. Any substantial relaxation of slaughter restrictions would lead to serious depletion, but that this is not at present the intention of the German Government is shown by its announcement that it will not raise the meat ration before the spring or even the summer.

FRENCH TRACTOR TRIALS.

WITH the object of bringing agriculturists into direct contact with makers of agricultural machinery, and to facilitate the choice by the former of motor machinery, the French Ministry of Agriculture, by a Decree of 29th February, 1916, provided for public trials of such machinery. An account of various trials conducted by the Director (M. Ringelmann), of the French Machine Testing Station, appeared in *La Vie Agricole* of 7th October, 1916, from which the present account is summarised.

In response to the requests of a large number of small holders, the particulars were obtained on the basis of a furrow of 164 yds. length only. The speed and the time taken in turning were noted, and hence the time taken to plough and cultivate 1 acre could be calculated. In reckoning this time, delays (such as would occur in practice) of 10 minutes in each hour were allowed for.

Particulars of the price, weight, and h.p. of the tractors tested are given in Table I., which also shows the results of the ploughing trials. It must be noted that although these ploughing results are summarised in one table, they are not strictly comparable, owing to differences of soil.

In the case of the powerful Salvert tractor the two front wheels are replaced by a cylinder (or, more correctly, two cylinders joined together), as in a road steam roller, the width being 55 in. and the diameter 40 in.; the pressure of the cylinder per sq. in. of the soil is stated to be very small.

TABLE II.—*Ploughing Trials.*

Tractor.	Depth.	Width.	Area Ploughed	Time Taken.		Consumption of Petrol.	Cost of Petrol per Acre.	
	in.	in.	acres.	hrs.	mins.	gal.	s.	d.
American ..	4·4	39	2·40	2	54	5·7	5	8
Amanco ..	4·0	45	2·36	2	49	4·7	3	4
Mogul	4·0	35	2·31	3	5	4·9	5	1
Bull	4·8	45	2·24	2	6	3·3	3	6
Case 10–20 h.p.	3·2	51	2·40	3	5	3·8	3	9
Case 12–25 h.p.	4·8	63	2·47	2	22	4·0	3	11
American ..	8	39	2·39	3	26	6·6	6	7
Amanco ..	8	45	2·38	—		6·6	4	7
Mogul	8	35	2·31	4	3	7·7	7	10
Bull	8	28	2·81	4	0	7·0	6	0
Case 10–20 h.p.	8	25	2·40	4	12	5·8	5	9
Case 12–25 h.p.	8	46	2·60	3	47	6·7	6	2

A further series of trials gave the results shown in Table II. (no particulars other than those shown were given in the report

TABLE I.—*Particulars of Tractors and Ploughing Trials.*

Tractor and Plough.	Soil.	Water content of Soil.	Density of Mineral Petrol.	Sp. gr. of Petrol.	H.P. of Tractor.	Weight of Tractor.	Price of Tractor.	Depth Ploughed.	Width.	Average Speed.	Time in Turning.	Time to plough 1 acre.*	Area ploughed per hour.	Consumption of Petrol. Per Hour.	Consumption of Petrol. Per Acre.
		per cent.				lb.	£	in.	in.	m. p. hr.	seconds.	minutes	acres.	lb.	lb.
Mogul:															
3 furrow	Light Sandy ..	10·4	725	1·38	16	6,040	320	6¼	38	2·03	25	105	0·57	12½	21
4 furrow					25	10,300	582	8¼	50	1·70	34	99	0·61	14¾	24
Baroncelli:															
4 furrow	Strong wet clay 3 years fallow	15·1	725	1·38	35	6,065	480	5¾	32	2·23	18	112	0·54	25½	48
4 furrow								6¼	39	1·65	31	126	0·48	21	44
4 furrow ..								6¾	24	2·28*	35	163	0·37	25	68
2 furrow								10½	26	1·41	38	230	0·26	18¼	70
Salvert:															
5 furrow	Light	16·6	722	1·39	35	14,640	1,140	6	95	2·00	54	49	1·22	23½	19
4 furrow								7	95	1·94	54	51	1·20	29	24
Emerson:															
Brabant 2 furrow ..	Strong, very wet clay, 3 years fallow.	14·9	725	1·38	20	6,170	504	6¼	24	3·28	30	116	0·52	19	37
Brabant 2 furrow ..								9	23	1·61	30	223	0·27	12	44
4 furrow ..								7	39	1·72	44	129	0·47	12	26
American 3 furrow								6	37	2·23	25	100	0·60	14	25
American 3 furrow								8¼	37	2·16	25	103	0·59	16	28
American 3 furrow..	Lucerne (3 year) ploughed in							5¼	37	1·72	30	107	0·47	17¼	36
American 3 furrow..								7¼	35	1·67	30	116	0·44	18¾	44

TABLE IV.—*Cultivation Trials.*

Tractor.	Depth.	Width.	Average Speed.	Time in Turning.	Time to Cultivate one acre.*	Area Cultivated per hour.*	Consumption of Petrol.	
							Per hour.	Per acre.
	in.	in.	m. per hr.	seconds.	minutes.	acres.	lb.	lb.
Mogul 16 h.p.: Land ploughed one week before ..	2·6	79	2·1	25	51	1·19	9·76	8·20
" " day before ..	4·4	79	2·1	25	51	1·19	10·67	8·90
Mogul 16 h.p., attached to Cultivator on fallow	2·8	79	2·1	25	51	1·19	8·86	7·45
Pulveriser on—(*a*) fallow	1·6	83	2·1	25	49	1·25	8·95	7·19
(*b*) recently ploughed land ..	4·0	83	2·0	25	49	1·24	11·50	9·30
Emerson 20 h.p. on land ploughed one week before: (1) Cultivator with 13 flexible teeth	4·0	61	1·9	30	73	0·83	13·93	16·80
(2) Cultivator with 13 flexible teeth together with a roller for breaking (width 71 in.)	4·0	61	1·8	35	75	0·81	16·73	20·90
(3) Harrow 48 teeth employed on land in (2)	1·8	79	3·3	30	35	1·73	18·12	10·58
Emerson 20 h.p. on fallow: Cultivator with 13 flexible teeth ..	4·0	61	1·7	35	77	0·80	13·82	17·51

from which this summary was made). The tractors were first tried at various depths and then all set to a uniform depth of 8 in.

A third series of trials was carried out on a wheat stubble on a chalky clay, which had got into very hard condition as a result of the absence of rain. The results are summarised in Table III.

TABLE III.—*Ploughing Trials.*

Tractor.	H.P.	Depth.	Area ploughed per hour.	Volume ploughed per hour.	Consumption of Petrol per acre, supposing a depth of 6¼ in. Ploughing.
		in.	acres.	cub. yd.	gal.
Bull	8-16	6¼	0·49	408	3·9
Mogul	8-16	6½	0·48	419	3·7 (paraffin)
Amanco	12-24	5¾	0·47	356	3·7 (paraffin)
Emerson ..	12-20	6¾	0·71	644	2·6
Case	12-20	7½	0·66	664	2·0
Mogul	8-16	6	0·51	402	4·3

Cultivation trials were carried out with the 16 h.p. Mogul and the 20 h.p. Emerson tractors. Particulars of the cultivating implements are given in Table IV., which also shows the results obtained. The pulveriser attached to the 16 h.p. Mogul weighed 463 lb. and had 14 discs of 20 in. diameter and 2 in. width through centre, together with a central tooth.

The road trials were carried out with the 16 and 25 h.p. Moguls, the 30 h.p. Baroncelli, and the 20 h.p. Emerson. The roads were metalled, level, dry, and in good condition. The tractors were set to draw one wagon only, although it would have been possible for them to draw several under such conditions.

The results are shown in Table V.

TABLE V.—*Road Trials.*

Tractor.	Total Weight of Wagon drawn.	Average Speed.	Consumption of Petrol	
			Per hour.	Per mile.
	cwt.	m. per hr.	lb.	lb.
Mogul 16 h.p.	133	2·19	5·9	2·7
Mogul 25 h.p.	133	3·41	11·4	3·3
Baroncelli 35 h.p.	133	2·61	27·0	10·4
Emerson 20 h.p.—				
(1) Rim of driving wheel provided with transverse iron bands ..	133	2·43	8·6	3·6
(2) Rim of driving wheel smooth	133	3·10	9·8	3·2
(3) Do., but different carburetter	133	2·61	11·9	4·6

FOOD SUPPLIES AND PRICES IN WAR TIME,

WITH SPECIAL REFERENCE TO IMPORTS.

THIS country has now passed through two complete calendar years of war, and it is of interest to examine the supplies and prices of imported and home food products during that time and to compare them with pre-war figures. It should be noted with regard to imports, that the Board of Trade accounts of goods imported *include all articles of food*, but not other goods which at the time of importation were the property of His Majesty's Government or the Governments of the Allies.

The total value of the principal articles of agricultural produce imported into the United Kingdom in 1916 was £305,493,000 as against £276,648,000 in 1915, £211,591,000 in 1914 £213,923,000 in 1913, and an average of £186,276,000 in the ten years 1903–1912. These figures represent the value (cost insurance and freight), as declared to the Customs officers at the port of arrival, of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard, and margarine, which may be grouped together as agricultural products in the sense that they compete more or less directly with the products of the farmers of the United Kingdom. If it is argued that imported sugar and tobacco are food products which compete with home produce the above figure for 1916 will have to be increased to £350,000,000.

There was thus the very large increase in the value of agricultural imports in the past year as compared with the last pre-war year, 1913, of £91,570,000, that is, an increase of 43 per cent.! These figures are an indication of the large sums of money annually paid by this country for its imported food, but they must not be used to compare the volume of the trade in recent years, since there has been an enormous inflation of prices since the commencement of the War.* The grain and flour imports, *e.g.*, accounted for just below one-half of the total figure given above for 1916; the value *rose* from £85,495,000 in 1913 to £133,307,000 in 1916, or by 56 per cent., while the quantity actually *fell* from 225,284,000 cwt. to 192,730,000 cwt., or by 14 per cent. The meat imports account for nearly one-third of the total figure; the value of the dead

* The 43 per cent. increase in value compares with an estimated rise in imported food prices (see p. 964) of 62 per cent., so that the volume must have shrunk by one-tenth since 1913.

meat rose from £55,309,000 in 1913 to £93,390,000 in 1916, or by 69 per cent., while the quantity remained practically stationary. From 1913 to 1916 the butter imports dropped by one-half in quantity, but by less than one-quarter in value. Of all the articles mentioned in the above list, cheese and margarine are the only two of which we have received appreciably increased quantities since 1913. The fluctuations in the trade of the various articles are fully considered below.

Meat.—*Cattle and Beef.*—No live cattle for food were imported in 1916. The United Kingdom is in a more favourable position than in 1913, however, as regards home live stock. The following are the figures for the last four years:—

	1916.	*1915.*	*1914.*	*1913.*
Cows and Heifers in milk or in calf	4,482,155	4,476,788	4,576,852	4,300,611
Other Cattle—				
Two years and above ..	2,341,395	2,218,246	2,326,584	2,479,753
One year and under two	2,792,191	2,656,053	2,587,853	2,571,767
Under one year ..	2,796,855	2,780,795	2,653,274	2,544,348
Total Cattle ..	12,412,596	12,131,882	12,144,563	11,896,479

The imports of beef (almost entirely chilled and frozen), after having steadily risen until in 1913 they reached the highest quantity yet recorded of 9,203,310 cwt., declined in 1914 to 8,844,567 cwt., in 1915 to 8,610,687 cwt., and in 1916 to 7,056,191 cwt. The imports of fresh beef were practically *nil*. The main source of supply of chilled beef is Argentina, from which country the comparatively small total of 1,275,647 cwt. was received, as compared with 1,702,186 cwt. in 1915, 4,649,718 cwt. in 1914, and 5,216,022 cwt. in 1913. The trade in chilled beef between the United States and this country revived in 1915, when 608,908 cwt. were sent, and in 1916 when 388,611 cwt. were received. Uruguay began to contribute to our supplies of chilled beef in 1913, the imports from that country in that year being 31,982 cwt.; these increased in 1914 to 160,412 cwt., and in 1915 to 289,113 cwt., but dropped again in 1916 to 171,117 cwt. The extension of the chilled beef trade (usually representing the better class of meat) was, until 1913, a noticeable feature of the dead-meat trade; but the total imports from all countries decreased in quantity from 5,248,004 cwt. in 1913 to 4,812,209 cwt. in 1914, 2,618,546 cwt. in 1915, and 1,872,090 cwt. in 1916.

The frozen beef imports decreased both in quantity and value in 1916; we received 5,184,056 cwt. valued at £16,193,037 in 1916, 5,981,048 cwt. valued at £17,767,446 in 1915, 4,027,106 cwt. valued at £8,734,610 in 1914, and 3,952,880 cwt. valued at £6,278,793 in 1913. The countries chiefly engaged in this trade are Argentina, Uruguay, Australia and New Zealand, and the United States. In 1916 the supplies were as follows (1913 figures in brackets):—United States, 541,596 cwt. (1,462 cwt.), valued at £1,952,614 (£3,119); Argentina, 2,762,031 cwt. (1,955,853 cwt.), valued at £8,132,495 (£3,085,628); Australia, 765,493 cwt. (1,347,464 cwt.), valued at £2,425,496

(£2,133,951); and New Zealand, 875,086 cwt. (244,168 cwt.), valued at £2,824 664 (£393,429). The United States had dropped out of this trade for several years previous to 1913.

Prices of Beef.—The average declared value of *chilled beef* was, per cwt., 37*s*. 3*d*. in 1913, 42*s*. 10*d*. in 1914, 61*s*. 7*d*. in 1915, and 73*s*. 3*d*. in 1916, *i.e.*, the price of this kind of beef has doubled since the last pre-war year. The average declared value of *frozen beef* was, per cwt., 31*s*. 9*d*. in 1913, 43*s*. 4*d*. in 1914, 59*s*. 5*d*. in 1915, and 62*s*. 6*d*. in 1916, *i.e.*, the price of this kind of beef also has doubled since 1913. Comparing the December, 1913, prices with December, 1916, prices it is found that *chilled beef* has risen from 40*s*. to 81*s*. 7*d*. per cwt. (*i.e.*, by 104 per cent.), and that *frozen beef* has risen from 36*s*. 5*d*. to 62*s*. 10*d*. (*i.e.*, by 72 per cent.). The prices of *home-killed beef* in the two Decembers, and the percentage increases in price were as follows (average of five English markets):—

	December, 1913.	*December, 1916.*	*Percentage Increase.*
	s. d.	*s. d.*	
Beef—			
English—1st quality ..	58 0	102 0	76
,, 2nd quality ..	54 6	96 6	77
Cow and bull—1st quality	50 0	88 6	77
,, 2nd quality	44 6	80 6	81
Irish, Port killed—			
1st quality	57 0	99 0	74
2nd quality	54 0	92 0	70

Sheep and Mutton.—There were no imports of live sheep for food in 1916.

Numbers of sheep in the United Kingdom have shown a steady (if small) increase since 1913, viz.:—

	1916.	*1915.*	*1914.*	*1913.*
Ewes kept for breeding	11,569,387	11,308,451	11,221,604	11,025,059
Other Sheep—				
One year and above	5,570,992	5,390,746	5,037,911	5,349,430
Under one year ..	11,630,313	11,499,245	11,626,580	11,177,647
Total ..	28,770,692	28,198,442	27,886,095	27,552,136

The quantity of mutton imported decreased from 5,119,731 cwt. in 1914 to 4,707,859 cwt. in 1915, and 3,636,563 cwt. in 1916. Nearly all of it came in the form of frozen mutton, chiefly from New Zealand 2,287,377 cwt. (2,200,525 cwt. in 1913); Australia, 261,352 cwt. (1,665,859 cwt. in 1913); Argentina, 768,259 cwt. (1,012,347 cwt. in 1913); and Uruguay, 20,834 cwt. (164,983 cwt. in 1913). The quantities received from New Zealand were greater than in 1913, but otherwise the figures show decreases. The quantity of fresh mutton received was only 16,510 cwt., practically all of this coming from Holland.

Prices of Mutton.—The average declared value of frozen mutton, per cwt., was 40*s*. 9*d*. in 1913 and 74*s*. 3*d*. in 1916, a rise of 82 per cent. Comparing December, 1913, prices with December, 1916, prices, the figures are 38*s*. 4*d*. and 78*s*. 4*d*., a rise of 104 per cent. The prices of English, Scotch and Irish mutton in December, 1913, and December, 1916, are shown in the following table, together with the percentage increase in price (average of 5 English markets):—

	December, 1913. s. d.	*December, 1916.* s. d.	*Percentage Increase.*
Scotch—			
1st quality	80 6	116 6	45
2nd quality	76 0	110 0	45
English—			
1st quality	77 6	117 0	51
2nd quality	72 0	109 6	52
Irish, Port killed—			
1st quality	75 0	107 0	43
2nd quality	69 0	101 6	47

The percentage rise in the home prices is less than half that of the prices of imported mutton.

Rabbits.—The receipts of fresh rabbits, mainly owing to the Belgian supplies being cut off, amounted to only 4,106 cwt. (43,614 cwt. in 1913), and the bulk of the rabbit supply was composed of frozen rabbits from Australia and New Zealand, the former country sending 601,720 cwt. (419,076 cwt. in 1913), and the latter 41,062 cwt. (62,883 cwt. in 1913). The value per cwt. of the frozen rabbits was 36*s.* 4*d* in 1916, as against 27*s.* 3*d.* in 1913, a rise of 33 per cent.

Pork.—A total of 293,333 cwt. of fresh and frozen pork was received in 1916, compared with 494.264 cwt. in 1913. Almost the whole in 1916 was frozen pork, coming mainly from the United States. The imports of salted pork (not bacon or hams) were 41,478 cwt. (240,597 cwt. in 1913).

Prices of Pork.—The declared value of imported fresh and refrigerated pork was 55*s.* 4*d.* in 1913, and 79*s.* 8*d.* in 1916, a rise of 44 per cent. The price in December, 1913, was 55*s.* 4*d.*, as compared with 88*s.* 11*d.* in December, 1916, a rise of 60 per cent. The rise in the price of home-killed pork was as follows (average of 5 English markets) :—

	December, 1913. s. d.	*December, 1916.* s. d.	*Percentage Increase.*
British Pork—			
1st quality	79 0	124 6	58
2nd quality	73 6	112 6	53

Here, again, the percentage rise in home meat prices was not so marked as with foreign meat prices.

The return of the number of pigs in the United Kingdom in 1916 compares satisfactorily with the figure for 1913, but not very satisfactorily with the figures for 1914 and 1915, viz. :—

	1916.	1915.	1914.	1913.
Sows kept for breeding..	432,831	437,828	492,981	400,978
Other Pigs	3,171,789	3,346,505	3,446,906	2,893,237
Total..	3,604,620	3,784,333	3,939,887	3,294,215

Bacon and Hams.—The imports of bacon in 1916 (7,435,955 cwt.) showed an increase compared with 1915, and the total is the largest recorded. Denmark sent 1,641,613 cwt., as compared with 2,063,221 cwt. in 1915, 2,714,807 cwt. in 1914, and 2,334,945 cwt. in 1913 ; and in these four years the United States sent 4,004,410 cwt., 3,529,599 cwt., 1,522,958 cwt., and 1,803,371 cwt. ; and Canada, 1,594,114 cwt., 864,185 cwt., 342,286 cwt., and 243,522 cwt.

Hams were imported to the extent of 1,554,836 cwt. in 1916, compared with 1,480,548 cwt. in 1915, 838,830 cwt. in 1914, and 854,995 cwt. in 1913. Nearly all came from the United States.

Prices of Bacon and Hams.—Imported bacon was valued at 92*s.* 6*d.* per cwt. in 1916 and 71*s.* 9*d.* in 1913, *i.e.*, there was a rise of 29 per

cent. Imported hams rose from 71*s*. 9*d*. per cwt. in 1913 to 88*s*. in 1916, a rise of 22 per cent. The rise from December, 1913, to December, 1916, is given in the following table for both imported and home produced bacon and hams (the prices of home produce represent the average of 3 English markets) :—

	December, 1913. s. d.	*December, 1916.* s. d.	*Percentage Increase.*
Imported Bacon ..	71 0	104 0	46
Irish (Green) Bacon—			
1st quality ..	74 0	121 0	64
2nd quality ..	70 0	115 6	65
Imported Hams ..	71 0	97 6	37
York Hams—			
1st quality ..	139 0	168 0	21
2nd quality ..	126 6	161 6	28
Irish Hams—			
1st quality ..	127 6	166 0	30
2nd quality ..	118 6	160 0	35

Irish bacon is the only class of meat which has risen in price, per cent., since December, 1913, more than the imported kind.

Imports of Live and Dead Meat.

Description.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	Number.	Number.	£	£
Cattle ..	14,743	—	304,312	—
Sheep and Lambs ..	501	—	751	—
Total live animals..	—	—	305,063	—
	Cwt.	Cwt.		
Beef, fresh and refrigerated ..	9,203,310	7,056,191	16,070,833	23,047,355
Beef, salted ..	49,834	65,512	111,070	215,334
Mutton, fresh and refrigerated ..	5,330,290	3,636,563	10,907,992	13,505,017
Pork, fresh and refrigerated ..	494,264	293,333	1,368,360	1,169,174
Pork, salted ..	240,597	41,478	297,135	135,422
Bacon ..	4,857,890	7,435,955	17,428,881	34,381,717
Hams ..	854,995	1,554,836	3,068,251	6,841,430
Meat, unenumerated—				
Fresh and refrigerated ..	728,329	704,668	1,429,997	1,928,927
Salted ..	104,138	27,519	138,409	109,538
Meat, preserved ..	889,005	1,884,749	3,707,054	10,876,892
Rabbits, dead ..	525,578	646,888	781,376	1,179,224
Total dead meat ..	23,278,230	23,347,692	55,309,358	93,390,030
Poultry—	Number.	Number.		
Alive ..	858,979	245	37,923	145
	Cwt.	Cwt.		
Dead ..	278,465	137,382	954,540	635,986
Game—				
Alive ..	—	—	43,412	17,116
Dead ..	—	—	76,115	15,160

Poultry and Game.—The number of live poultry imported dropped from 858,979 in 1913, valued at £37,923, to 541,161 in 1914 valued at £23,698, 19,434 in 1915 valued at £1,079, and 245 in 1916 valued at £145. Dead poultry is chiefly received from Russia, the United States and France; there was a decrease in both quantity and value compared with the preceding three years. The value of the imported live game was £17,116, and of dead game £15,160.

Total Imports of Meat.—It appears that the quantity of meat of all kinds (excluding poultry and game) available in addition to the home supply, was about 23,347,692 cwt., as compared with 25,276,000 cwt. in 1915, 23,588,000 cwt. in 1914, and 23,278,000 cwt. in 1913. This was not entirely consumed in this country, as there was a very small re-export.

The total value credited to the different kinds of live and dead meat, including poultry and game, was £94,058,000 in 1916, as compared with £86,839,000 in 1915, £63,215,000 in 1914, and £56,726,000 in 1913.

The home production of meat before the War formed about 60 per cent. of the total supply.

Dairy Produce.—*Butter.*—Two-thirds of the butter supplied to this country from abroad came from the Continent of Europe, Denmark (1,134,801 cwt.), Russia (34,542 cwt.), France (130,249 cwt.), and Holland (36,302 cwt.) being the chief contributors. Almost the whole of the remainder was received from Australia (140,510 cwt.), New Zealand (331,162 cwt.), Argentina (117,597 cwt.), United States (131,018 cwt.), and Canada (101,531 cwt.).

The quantity of butter received was below the imports of 1915, 1914, and 1913. The value was 174*s.* 3*d.* per cwt., as compared with 140*s.* 3*d.* in 1915, 120*s.* 7*d.* in 1914, and 116*s.* 5*d.* in 1913.

The prices of imported butter in December, 1913, and December, 1916, are compared with British and Irish butter prices (average of 3 English markets) at the same dates in the following table:—

	December, 1913.		*December, 1916.*		*Percentage Increase.*
	s.	*d.*	*s.*	*d.*	
Imported (per cwt.) ..	122	6	211	0	72
British (per 12 lb.)—					
1st quality	16	0	23	6	47
2nd quality	14	6	22	6	55
Irish Creamery (fresh), (per cwt.)—					
1st quality	128	0	217	0	70
2nd quality	124	0	213	6	72
Irish Factory (per cwt.)—					
1st quality	106	6	194	0	82
2nd quality	98	6	188	6	91

Irish butter is seen to have increased by as much per cent. as, or more than, imported butter.

Cheese.—The supply of cheese was larger than in 1913, but slightly smaller than in 1915. Half our imported cheese comes from Canada; the imports from this source in 1916 were 1,505,018 cwt. New Zealand sent 667,214 cwt.

The prices of imported cheese at December, 1913, and December, 1916, are compared with those of the home make at the same dates (average of 3 English markets) in the following table:—

	December, 1913. s. d.	December, 1916. s. d.	Percentage Increase.
Imported (per cwt.)	62 0	126 0	103
British Cheddar (per cwt.)—			
1st quality	82 0	135 6	65
2nd quality	75 6	130 6	73
British Cheshire (per 120 lbs.)—			
1st quality	83 0	157 6	90
2nd quality	77 6	151 0	95

Eggs.—The supply of eggs steadily increased in recent years, viz., from 17,710,431 great hundreds in 1909 to 21,579,950 in 1913; in 1914, however, the imports dropped to 17,904,805 great hundreds, and there was a further very large fall in 1915 to 10,246,026 great hundreds, and in 1916 to 6,606,411 great hundreds. Russia and Denmark are usually the chief contributors to the trade, but, compared with 1913, the supplies from Denmark decreased from 4,264,943 great hundreds in 1913 to 1,392,061 in 1916, and those from Russia from 11,453,277 in 1913 to 734,525 in 1916. Egypt and Canada are now sending us large and increasing supplies.

The Trade Returns now distinguish the "egg yolk, and liquid, and albumen" imported, the total value of which was £845,564 in 1915, and £1,393,141 in 1916.

The prices of imported eggs in December, 1913 and December, 1916, are compared with the prices of home produced eggs (average of 3 English markets) at those dates in the following table (per great hundred):—

	December, 1913. s. d.	December, 1916. s. d.	Percentage Increase.
Imported	10 6	18 0	71
British—			
1st quality	19 0	36 0	89
2nd quality	18 6	33 0	78
Irish—			
1st quality	17 0	31 6	85
2nd quality	14 6	29 6	103

Eggs furnish another example of home produce having increased in price to a greater extent than the imported article.

Imports of Dairy Produce, Margarine, and Eggs.

Description.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	Cwt.	Cwt.	£	£
Butter	4,139,028	2,178,029	24,083,658	18,977,450
Margarine	1,518,297	2,752,866	3,917,701	8,983,007
Cheese	2,297,340	2,604,027	7,035,039	12,945,450
Milk, condensed	1,252,236	1,709,919	2,185,462	5,005,404
	Great hundreds.	Great hundreds.		
Eggs	21,579,950	6,606,411	9,590,602	4,741,401

Grain and Meal.—There was a decline in the imports of wheat in 1916, compared with pre-war figures. The leading sources of supply were India (5,611,900 cwt.), Canada (21,549,200 cwt.), Argentina (4,495,700 cwt.), United States (64,544,100 cwt.), the noteworthy features in 1916 being the almost total disappearance of Russian wheat from the trade, a doubling of United States supplies compared with 1913, and large declines in the supplies from Argentina and India.

The receipts of flour showed a large decline compared with 1913, chiefly as a result of the Continent dropping out of the trade.

The total normal wheat (*i.e.*, grain, wheatmeal and flour) requirements of the United Kingdom, from home and overseas, are about 150 million cwt., the home production forming about 22 per cent. of the whole; this is shown in the following table :—

Annual Average.	Normal Requirements.	Supplies.		Proportion of Supply.	
		Home.	Over-seas.	Home.	Over-seas.
	Million cwt.	Million cwt.	Million cwt.	Per cent.	Per cent.
1901–05	138.8	28.7	110.1	20·7	79·3
1906–10	143.2	31.9	111.3	22·3	77·7
1911–13	149.2	32.9	116.3	22·1	77·9

The imports of barley, after rising in 1913, dropped again in 1914, 1915 and 1916. The principal contributors were the United States (9,028,500 cwt.), India (2,868,100 cwt.), and Canada (2,832,600 cwt.). Russia and Rumania dropped out of the trade. The imports of barley normally form about 40 per cent. of the total estimated consumption.

Imports of Grain and Flour.

Description.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	Cwt.	Cwt.	£	£
Wheat	105,878,102	100,068,520	43,849,173	72,011,375
Wheat meal and flour	11,978,153	9,960,333	6,347,771	8,568,134
Barley	22,439,248	15,823,700	8,077,100	10,413,138
Oats	18,162,663	12,602,600	5,671,957	6,597,577
Oatmeal	868,877	973,333	607,761	986,855
Maize	49,154,953	34,154,210	13,769,793	19,896,157
Maize meal	491,827	418,643	182,413	246,713
Peas	1,978,315	991,121	1,006,735	1,290,024
Beans	1,540,405	1,116,725	568,189	690,732
Other corn and meal..	12,791,419	16,620,983	5,413,736	12,606,239
Total	225,283,962	192,730,168	85,494,628	133,306,944

Oats amounting to 12,602,600 cwt. were imported in 1916, this figure being a drop of 5,560,000 cwt. compared with 1913! None came

from Russia, Germany or South-Eastern Europe, but the United States increased its supplies from 1,434,015 cwt. in 1913 to 5,200,100 cwt. in 1916. The imports of oats form normally about 25 per cent. of the total estimated consumption.

The supply of maize, 34,154,210 cwt., compares with 49,154,953 cwt. in 1913.

Cereal crops in the United Kingdom in the last four years have been as follows (quarters):—

	1916.	*1915.*	*1914.*	*1913.*
Wheat ..	7,471,302	9,239,355	7,804,041	7,087,050
Barley ..	6,612,852	5,862,244	8,065,678	8,204,066
Oats ..	21,334,841	22,308,395	20,663,537	20,660,279
Beans ..	892,814	924,155	1,120,078	950,309
Peas ..	—	300,338	374,038	423,235

The outlook as regards foreign supplies is not very hopeful. The following figures are given by the International Agricultural Institute (latest returns for various countries in Europe, America, Asia, and Africa):—

	1916. *qr.*	*1915.* *qr.*	*Percentage Decrease.*
Wheat ..	309,665,000	412,962,000	25·0
Rye ..	115,344,000	121,140,000	4·8
Barley ..	123,020,000	135,564,000	9·3
Oats ..	323,813,000	374,082,000	13·4
Maize ..	320,098,000	381,758,000	16·2

Besides the above there is an estimated decrease of 55 per cent. in the Argentine wheat crop, viz., from 21,560,000 qr. to 9,670,000 qr. The Australian crop is, however, estimated to have increased from 17,870,000 qr. in 1915-16 to 18,587,000 qr. in 1916-17, or by 4 per cent.

Prices of Cereals.—The following table shows the average value per Imperial quarter of wheat imported from various countries:—

	1913. *s. d.*	*1914.* *s. d.*	*1915.* *s. d.*	*1916.* *s. d.*
Argentina ..	35 8	34 1	60 8	65 3
Chile ..	36 7	35 7	—	68 3
Russia ..	33 11	33 6	50 0	53 1
United States ..	35 1	37 3	54 7	61 1
Australia ..	37 6	36 6	44 9	63 11
British East Indies ..	36 6	39 5	54 4	68 1
Canada ..	34 8	37 5	54 10	60 7
New Zealand ..	35 5	37 7	—	74 6

The average declared values of the cereals from all sources together will be found in the table on p. 964. This shows percentage rises in price since 1913, as follows:—Wheat 74, wheat flour 62, barley 84, oats 68, and maize 109 per cent. The price of oats has, however, dropped in comparison with 1915.

The prices of British corn will be found on p. 1038. The wheat price (58*s.* 5*d.* per qr.) is the highest since 1873, the barley price (53*s.* 6*d.* per qr.) is the highest since 1818, while the price of oats (33*s.* 5*d.* per qr.) is the highest since 1813! The percentage increases of prices since 1913 have been:—Wheat 84, barley 96, and oats 75 per cent., each of these home-grown kinds having thus increased more in proportion than imported kinds.

Fruit and Vegetables.—The quantity of potatoes received (1,803,174 cwt.) was less than one-fifth of that in 1913. The imports from all countries decreased. The chief countries in this trade were Holland, France, and the Channel Islands; Germany, of course, ceased to export. The other vegetables imported are mainly onions and tomatoes; 6,843,247 bush. of onions, valued at £2,062,149, and 1,649,282 cwt. of tomatoes, valued at £1,945,965, were imported. The United Kingdom crop of potatoes in 1916 was 5,468,247 tons, compared with 7,604,804 tons in 1913—a serious drop.

Hops were imported to the extent of 148,407 cwt., as against 262,184 cwt. in 1913.

Food Prices.—Prices have already been discussed under the heads of the several articles of food; the prices or imported foods have, however, been brought together in the table below, which gives the average declared values of the produce in the last four years. There is, of course, the danger that the expressions "cheese," "butter," "wheat" may mean a different quality of article in 1916 as compared with 1913, especially in view of present fluctuations, when the produce of some countries is dropping out from the trade (*e.g.*, Russia) while that of other countries (*e.g.*, United States) has largely increased. With this reservation it may be said that the record for the past year shows a very decided increase in the prices of all food products (except oats). If the rises in price of the articles of food (*i.e.*, excluding wool) in the table below are weighted approximately according to their importance,* the rise in prices of food imports since 1913 is found to be 62 per cent. The increases per cwt. since 1913 were as follows:—

Average declared Values of Agricultural Produce Imported.

Description.		1913.	1914.	1915.	1916.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cattle	head	20 12 10	20 14 6	—	—
Sheep and lambs	,,	1 10 0	1 15 2	—	—
Beef, fresh and refrigerated	cwt.	1 14 11	2 3 1	3 0 1	3 5 4
Mutton, fresh and refrigerated	,,	2 0 11	2 3 11	2 18 11	3 14 4
Pork, fresh and refrigerated	,,	2 15 4	2 14 10	2 19 1	3 19 8
Bacon	,,	3 11 9	3 11 6	3 18 0	4 12 6
Hams	,,	3 11 9	3 13 0	3 11 4	4 8 0
Butter	,,	5 16 5	6 0 7	7 0 3	8 14 3
Cheese	,,	3 1 3	3 5 6	4 1 6	4 19 5
Eggs	great hundred	0 8 11	0 9 8	0 11 11	0 14 4
Wool	lb.	0 0 10½	0 0 10½	0 0 11	0 1 2
Wheat	cwt.	0 8 3	0 8 7	0 12 11	0 14 5
,, flour ..	,,	0 10 7	0 11 0	0 15 10	0 17 2
Barley	,,	0 7 2	0 7 0½	0 9 10	0 13 2
Oats	,,	0 6 3	0 6 7	0 10 10	0 10 6
Maize	,,	0 5 7	0 6 0	0 7 9	0 11 8

* The following weights have been taken: Wheat 72, bacon 34, beef 23, maize 20, butter 20, mutton 13, cheese 13, barley 10, wheat flour 9, oats 7, hams 7, eggs 5, pork 1. These are not strictly accurate, but Bowley has shown that errors in the weights make little (if any) difference in the result.

Beef, 20*s*. 5*d*. (59 per cent.); mutton, 33*s*. 5*d*. (or 82 per cent.); pork, 24*s*. 4*d*. (or 44 per cent.); bacon, 20*s*. 9*d*. (or 29 per cent.); hams, 16*s*. 3*d*. (or 23 per cent.); butter, 57*s*. 10*d*. (or 50 per cent.); cheese, 38*s*. 2*d*. (or 62 per cent.); eggs, 5*s*. 5*d*. (per great hundred) (or 61 per cent.); wheat, 6*s*. 2*d*. (or 75 per cent.); wheat flour, 6*s*. 7*d*. (or 62 per cent.); barley, 6*s*. (or 84 per cent.); oats, 4*s*. 3*d*. (or 68 per cent.); and maize, 6*s*. 1*d*. (or 109 per cent.).

In conclusion, it may be of interest to indicate the proportionate production in the United Kingdom of the chief articles o: :ood before the outbreak of war:—

—	1901–5.		1906–10.		1911–13.	
	Home Supply.	Overseas Supply.	Home Supply.	Overseas Supply.	Home Supply.	Overseas Supply.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Meat ..	59·3	40·7	58·8	41·2	59·2	40·8
Wheat ..	20·7	79·3	22·3	77·7	22·1	77·9
Barley ..	57·5	42·5	62·1	37·9	57·4	42·6
Oats ..	77·5	22·5	80·3	19·7	75·1	24·9
Potatoes	93·8	6·2	96·9	3·1	98·1	1·9

WAR FOOD SOCIETIES.*

Food is as important as munitions. All can help to win the War by doing their utmost to increase food supplies.

IN the interests of the country it is of vital importance to produce as much food as possible during the coming year (1917). It is not sufficient to depend entirely on the farmers, who are hampered by lack of skilled labour and will experience difficulty in maintaining their normal output. To supplement their efforts every man or woman who has any spare time at his or her disposal should devote it to adding to the food supplies. Many who would gladly help are unable as individuals to obtain land, or are too inexperienced to make use of it if they can secure it, and to ensure that the country shall have the full benefit of the services of these workers, the Board suggest that War Food Societies should be formed in every parish.

The objects of such societies should be to secure increased production of food both by improving the methods adopted in existing gardens and allotments and by obtaining additional

* This article is an extract from the revised edition (December, 1916) of the Board's Special Leaflet No. 32.

land for the use of those who are willing to cultivate it. They should also arrange for the cultivation of allotments belonging to men who are on active service, and for the disposal of surplus produce.

The form the societies will take will depend to some extent upon local conditions. In urban and suburban areas, and often even in the larger villages, there is a very large number of spare time workers who would be willing to assist if the land could be provided for them. In these districts War Food Societies could do very valuable work by stimulating interest in the subject and by organising the work of producing food on systematic lines. Many excellent examples of what may be done in this direction already exist. For example, the Home Food Culture Society has obtained from land owners in Cumberland and Westmorland a number of plots of land free of rent, rates and taxes for use as allotments. The society provides technical advice and organises a supply of seedling plants. Similar work is being done by the Vacant Land Cultivation Society and the Church Army in London, and by the Croydon Vacant Lands Cultivation Society.

Women's Institutes.—In many country villages very little spare time male labour will be available, and the tending of allotments and gardens must devolve largely on women. Work of this character might be actively helped by the formation of Women's Institutes, either in place of War Food Societies or in affiliation with them. The general object of such institutes is to improve the conditions of women living in the country,* and as permanent institutions they might well play a most important part in rendering village life more attractive. At present they can find no better or more important outlet for their energies than in promoting the local production of food, or endeavouring to effect such economies as will not only make things easier for themselves but will aid the nation as a whole to win the War.

A number of institutes have already been formed in different parts of the country, and it may prove suggestive to those proposing to form institutes in other districts to give a few examples of what has already been done by them in the way of assisting in the production of food.

At Criccieth an institute was started on 12th January, 1916. Since then monthly meetings have been held and special

* Women's Institutes, for instance, could do valuable work by providing instruction in such subjects as the care of infants, economical cookery, and household management.

attention has been given to arranging lectures on the cultivation of gardens for better food production. The members, of whom there are about 80, are drawn from all classes of the community, but the greater number are the wives and daughters of small holders who, owing to home duties, are unable to go out to work on other farms. In June a weekly market was opened for the use of the members. Up to September the value of produce sold, raised entirely by the women themselves, amounted to £204 10s. This is the surplus produce beyond the home requirements or any local orders which the grower may have procured for herself.

At the institute at Wivelsfield displays of vegetables are arranged. These are judged by a local gardener who also gives simple advice as to the best methods of growing vegetables.

An institute at Kelmscott has been in existence since June, 1916, and nearly every woman in the village has joined it. Practically every member has responded to the appeal for women workers on the land, and is doing what she can, either to help the farmers or to grow more food in her garden or allotment.

How to Start a Food Society or Women's Institute.—In parishes where a War Savings Association or a gardening or allotment society already exists it might be used as a nucleus for a food society. Indeed, it is probable that the 900 War Savings Committees which exist throughout England and Wales would prove highly suitable bodies to promote the formation of both War Food Societies and Women's Institutes; while the 16,000 War Savings Associations might, in very many cases, add to their functions the work of Food Societies. In any parish, however, the initiative in forming a society or institute may be taken by any local resident.

In the formation of a *society* it is desirable in all cases to secure the co-operation of members of the Town, Urban, District or Parish Council with a view to making it representative of all classes of the community. The Chairman of the Local Authority might be invited to call a meeting of local residents, allotment holders, etc., to consider whether such a society should be formed, what steps are desirable to procure land for cultivation, and to appoint a standing committee. In villages where a *women's institute* is likely to be useful women of local influence might be approached and invited to take the initiative in its formation and to encourage others by taking part in the actual work. Advice and assistance in the formation of War Food Societies can be obtained from the Agricultural Organisa-

tion Society, Queen Anne's Chambers, Tothill Street, Westminster, London, S.W., who will also supply a set of model rules. The registration of societies under the Industrial and Provident Societies Act, or the Friendly Societies Act, is not essential. The Society should also be consulted when it is proposed to form a Women's Institute.

Methods of Work.—The first care of a food society should be to ensure that existing allotments and gardens, including those of men on active service, are fully cropped. After this has been arranged for, the society should ascertain what vacant or uncultivated land is available in the district. Powers have recently been conferred on the Board of Agriculture and Fisheries by a Regulation under the Defence of the Realm Act to enter forthwith upon any unoccupied land, *i.e.*, land which is not liable to poor rates, and to arrange for its cultivation by letting it to a society or to individual cultivators. In urban areas the powers of the Board have been delegated to the Town or Urban District Councils, to whom applications for the use of unoccupied land should be made. In rural areas any society which is prepared to undertake the cultivation of any unoccupied land should apply to the Board of Agriculture and Fisheries, giving full particulars of the land in question. The possession of any land taken under the Regulation will continue for the duration of the War and for such further period as may be necessary to secure any annual crops on the land at the time the War ends. No compensation on quitting will be payable to the cultivators unless they are disturbed prior to 1st January, 1918.

Co-operation in Buying Seeds, Manures, etc.—The society should endeavour to organise the supply of seeds, manures, plants, tools, feeding stuffs, etc., for the use of its members, and it might arrange to purchase these in bulk from a local Agricultural or Industrial Co-operative Society. A very useful development would be the formation of a co-operative credit society among the members. The Agricultural Organisation Society will gladly assist in this.

Disposal of Produce.—The society should endeavour to see that as far as possible the gardens or allotments are used for the production of food for home consumption. It is most desirable in these times that each household should produce as much food as possible for itself, and so save money and also reduce the consumption of food which has to be imported from abroad. If there is any surplus produce, the society should try and organise its collection and sale to a local Agricultura

or Industrial Co-operative Society, to local tradesmen, or to private customers. It is desirable to enquire from any possible purchasers the class of produce which is most needed in order to advise what should be grown.

Advice.—Societies should make a point of obtaining expert advice in their work. Reference should be made to Leaflet No. 279 (*Technical Advice for Farmers*) which contains particulars of the system which has been set up for providing expert advice on all agricultural questions, and gives the names and addresses of the persons from whom advice can be obtained in each county. In addition, special War Agricultural Committees have been established by the County Councils in most counties and districts and their assistance should be sought in cases of difficulty. In most villages the landowners and principal residents will be ready to lend the services of their gardeners for instruction and advice, and in many cases also the village schoolmaster is competent to give a great deal of help.

Prizes.—In order to stimulate production and to give the members an added interest in their work a small fund might be raised by the society for the purpose of giving prizes for the best cultivated allotments or for the best crops produced.

Suggestions for Work.—Some suggestions for the work of War Food Societies are given in Special Leaflet No. 32, together with references to Leaflets issued by the Board which may be of assistance.

These suggestions do not, of course, apply equally to all the societies that might be formed. Urban or suburban societies would usually concern themselves with gardening, or with gardening and poultry keeping, while in the country pigs could be kept in addition, and food and litter collected to supplement what was grown.

In this connection it should be borne in mind that in gardens at the present time those crops should be grown which are of most value for human food. Among these may be specially mentioned potatoes, beans, peas, parsnips, carrots, cabbages and allied species, onions, beet, turnips and Jerusalem artichokes.

SOMERSET POTATO SCHEME.

J. H. BURTON, M.Sc.,
Agricultural Organiser for Somerset.

IN the July, 1916, issue of the *Journal* a brief account was given of the scheme carried out during the past season by the Agricultural Instruction Committee of the Somerset County Council for the distribution of Scotch seed potatoes among allotment holders and small cultivators throughout Somerset. A general outline of the scheme was presented, and, incidentally, some of the difficulties met with were pointed out. At that date, however, it was not possible to make any statement as to the final result of the scheme. As the scheme is one which has been accepted by the Board as a model for adoption by other counties, such a final statement may usefully be given.

It may be said at once that though there was some grumbling at planting time, chiefly with respect to the size of some of the "seed" supplied, the scheme in the end proved an unqualified success. Generally speaking, the potato crop in Somerset, like that in most parts of the country, was not a good one. A form of leaf curl, known locally as "rust," was extremely prevalent. The effect of this is to produce a poorly-developed, stunted growth of haulm and a correspondingly small yield of tubers. Crops grown from the Scotch seed supplied were entirely immune from attack, and the lusty, vigorous growth of haulm was so marked in contrast with that of potatoes grown from local stocks that it was possible to pick out the former with almost absolute certainty in every case.

The promise given by the appearance of the tops was amply fulfilled when the potatoes came to be dug. Reports received from all parts of the county testified to the marked increase in crop resulting from the introduction of the Scotch seed. When the scheme was recommended for adoption the probable increase was estimated at not less than 50 per cent. From weighings actually made on a number of allotments, it was found that the average crop of marketable potatoes from local seed was about 3 tons per acre, whereas Scotch seed of the same variety (Up-to-Date) yielded about 10 tons per acre. The actual increase, therefore, was more than 300 per cent. On this basis it may be estimated that the 187 tons of Scotch potatoes supplied gave a yield of, roughly, 2,500 tons of marketable tubers. If, instead, local seed had been planted, on the same basis, the crop would have been, roughly, 750 tons.

The *increased production* due to the introduction of Scotch seed may be set down therefore at 1,750 tons of marketable potatoes. If similar results could be secured in every county in England and Wales, it is obvious that a very material contribution to an increase of the national food supply would ensue.

Not only were much heavier yields obtained, but the prevalence of disease (*Phytophthora*) was very much less in the Scotch than in the local stocks. Actual weighings at a number of centres showed that there was, on the average, more than four times the percentage of disease among the locally-grown potatoes.

Apart from the actual increase of the food supply which was the main object, it may be pointed out that the educational value of this scheme has been enormous. It is very difficult to convince the average allotment holder by argument, or even by figures obtained by someone else, that change of seed is profitable. If, however, he is supplied with a bag of Scotch seed from which he digs 10 bags of sound potatoes, whereas from his own seed which he has carefully treasured from year to year he gets only 2 or 3 bags, he begins to think. When he finds that all his neighbours who have planted fresh seed have a like experience, he and they become firm converts to the benefits of change of seed.

Owing to the success of the scheme last year it has been decided to continue it during the coming season on the same lines as before, except that no purchaser will be allowed to buy more than 1 cwt. of potatoes. The varieties offered are Arran Chief and Dalhousie, the prices being 17*s*. 6*d*. and 16*s*. 6*d*. per cwt. respectively, delivered to the nearest railway station. Owing to the conditions prevailing, it was found impossible to get a firm quotation which would be kept open till orders had been secured. It was, therefore, necessary to buy "on the nail" and 50 tons of potatoes were purchased by the Council, who took the risk of selling. Judging by present indications there seems little doubt as to the whole being sold. In the event of a greater quantity of seed being applied for, it is hoped that it will be secured direct or under the scheme outlined by the Board.

In conclusion, a few practical hints may be of use to those intending to carry out a similar scheme.

1. Heavy cropping sorts of good cooking and keeping quality should be selected. Arran Chief did remarkably well in Somerset, and, generally, was the favourite among the three

sorts supplied. The only objection found was a tendency to "double shoot" or "grow out" which was not observed during the previous season.

2. If possible not more than two varieties should be offered. The larger the number of sorts supplied, the more difficult it becomes to work the scheme. Arran Chief, and a potato of the "Up-to-Date" type—Up-to-Date, Dalhousie or Factor—make a good selection.

3. There need be no hesitation in buying "seed and ware" of the varieties named if "seed" cannot be purchased, as these sorts stand cutting well. It should be made clear, however, in the circular sent out whether seed size is being supplied.

4. In these times it is difficult to get a merchant to enter into a very stringent agreement, but a definite assurance should be obtained that the potatoes will be carefully loaded so as to protect them against frost and against undue chafing of the bags in transit, that all diseased tubers will be picked out, that full weight will be given, and that only sound bags will be used.

5. A definite guarantee as to the source of origin of the potatoes should be insisted on. This is especially necessary just now, as it is commonly stated that considerable quantities of Lincolnshire potatoes have been sent into Scotland during the current season.

Hints on Purchasing "Seed" Potatoes.*

IN 1917, and so long as the War lasts, all who have the opportunity of growing field or garden crops should do everything possible to contribute to the national food supply. Potatoes are one of the most important of these crops.

Those who wish to grow potatoes successfully must attend chiefly to the following two points :—

1. The selection of seed.
2. The preparation and manuring of the soil.

Another point, the prevention of disease, is of much importance in some districts and for certain kinds of potatoes.

This leaflet deals with the first point only, the others are referred to in other leaflets.† The immediate need of the grower who proposes to plant potatoes in March or April is to secure good "seed," and he ought to set about it without delay.

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* This article is a reprint of Special Leaflet No. 68, copies of which will therefore not be sent to subscribers to the Journal.

† Special Leaflet No. 1 (*Suggestions to Allotment Holders for Autumn Treatment of Land*); Leaflet No. 173 (*Potato Growing*); and Leaflet No. 296 (*Potato Growing in Allotments and Small Gardens*).

The "Seed" Potato.—The potato "seed" or "set" is, of course, not a seed at all, but a tuber, and in this leaflet the word seed means tuber; the potato tuber is a modified underground branch. Potato plants may be raised from true seed, and it is by this means that new varieties are commonly produced. When a new and promising variety is discovered it is propagated by its tubers until in time it may occupy many thousands of acres, but it is still in a sense an "individual" plant; unlike wheat, each annual crop is not a new generation, and thus the potato "grows old" (just as animals grow old) and becomes enfeebled and ultimately disappears. The rate at which a variety deteriorates depends on several circumstances. Each new variety of potato has a constitution of its own, since it is a new "individual." Some kinds retain their vigour for a few years only, others for a long time; thus the variety Up-to-Date has been common for about 30 years. It is now too old for many districts; but in others it is still useful.

None of the potatoes ripening from August onward can long stand cultivation in a hot and dry district. Thus if Up-to-Date potatoes from Scotland were planted on well-cultivated dry soil in the south of England, the first crop would perhaps amount to 8 tons or more per acre; if "sets" saved from the crop were again planted, possibly 6 tons would result; but if the process were repeated the third crop might not exceed 3 tons. If seed from Scotland were planted in south Lincolnshire the rate of deterioration would be less rapid, and the second crop might equal the first. It would ripen rather earlier, and as compared with fresh seed from Scotland the weight secured from the "once grown seed" would depend chiefly on the character of the season. If, however, "twice grown" seed were used there would undoubtedly be a sharp fall in the yield of the crop.

Changes from the cool climate of Scotland or the north of Ireland are necessary to secure the best results in potato cultivation. The degree of benefit to be expected from the change depends upon the variety of potato, and is known to growers and dealers.

There are so many considerations to be taken into account that, in ordering seed, potato growers who are not themselves familiar with the subject, should always order through an experienced and reliable dealer.

It is recognised that for England generally it is desirable to have seed from Scotland or the north of Ireland at least every second year; unless this rule is followed the best results cannot

be expected. Results ranging from fair to good, may, however, be secured by getting seed from the north of England, and generally by transferring seed from late to early districts. A change from peaty soil in a late district to a loam in an early district is often markedly beneficial. The benefits of a change vary with the seasons; after a cold and wet season such as that of 1916 the quality of the seed potatoes grown in England, except in those districts where growth was arrested by drought in July, should be better than usual.

Size of "Seed" Potatoes.—Potatoes intended for seed are usually separated from cooking potatoes by dressing the tubers on a $1\frac{5}{8}$-in. or $1\frac{3}{4}$-in. riddle; those too small for cooking which pass through the riddle are again dressed over a $1\frac{1}{4}$-in. riddle so as to separate out very small tubers. The "seconds" thus obtained form the best tubers for seed purposes. It usually takes 2 cwt. of potatoes of this size to plant 20 sq. rods ($\frac{1}{8}$ acre).

When potatoes are scarce and dear small potatoes which pass through a $1\frac{1}{4}$-in. riddle but remain on a 1-in. riddle may be used for seed; these are known as "thirds" or "chats," and early potatoes of this size are usually quite satisfactory. In rich loamy soils, and in moist districts, small tubers of second early and maincrop varieties are also quite reliable; but they are less satisfactory than ordinary seed size in dry soils. It is much better, however, to plant Scotch "thirds" than ordinary seed from crops grown for two years and more in England south of a line between, say, Hull and Chester.

"Thirds" are not only considerably cheaper than seed size, but they go further. About $1\frac{1}{4}$ cwt. will plant 20 rods; even 1 cwt. would suffice, but it is desirable to plant "thirds" a good deal closer than ordinary seed. The latter are generally placed 14 in. to 16 in. apart in the rows, the former 10 in. to 12 in.

As the best Scotch varieties are very scarce this year they are being dressed for seed purposes over 1-in. riddles, so that "thirds" may not be procurable; but of the commoner sorts there will be an unusual number of "thirds" because of the very unfavourable season.

"*Large Seed.*"—Some of the most popular Scotch varieties, such as "Arran Chief" and "Great Scot," are being sold, "as grown," over 1-in. riddles, no cooking potatoes being removed. This means that many of the tubers will be much too large for seed. When large tubers are planted whole the cost for seed is much enhanced, and the resulting crop is likely

to consist of many undersized potatoes. In most cases large potatoes should be cut before planting.

Cutting "Seed" Potatoes.—Some varieties, such as Up-to-Date and Abundance, stand cutting well; others, such as King Edward and Ninetyfold, may be much injured by cutting; others again, such as Arran Chief, are uncertain. Cut tubers are always less safe for planting in dry soils than in moist loams, and are less satisfactory in a dry than in a moist spring, but every kind of potato can be cut and successfully used under all ordinary conditions if carefully treated. Two points must receive attention. The grower should make certain that an "eye" or bud capable of growth is present in the set (if the potatoes have been slightly sprouted there is no difficulty in deciding as to this point), and the cut surfaces should be sprinkled with slaked lime which forms a crust and prevents the potato drying after it has been cut. This is especially necessary if there is any likelihood of delay between cutting and planting.

Sprouting "Seed" Potatoes.—This means starting the growth of the potatoes before planting. The usual practice is to place the tubers in shallow trays or boxes (hence the method is often called "boxing" potatoes) so that the tubers may start growth in the early spring months. When properly carried out (*see* Leaflet No. 173) the practice is most useful and results in a much earlier crop of early varieties, and generally in an earlier and larger crop of the later kinds. Those who intend sprouting sets must be prepared to carry out the instructions given in Leaflet No. 173 carefully. If there is inattention so that the sprouts grow long and weak the crop will be much injured.

How to Secure "Seed."—The only way to secure a supply of satisfactory seed in most districts this season will be for growers to combine and make up joint orders. If possible, arrangements for consignments of at least 4 tons should be made so as to save carriage.

The Board have asked the War Agricultural Committees to endeavour to arrange for the joint purchasing of seed potatoes, and also to give every possible encouragement to allotment societies or to clubs specially formed for the purpose of securing good seed. The quantity of seed to be distributed to any one grower under this scheme must not exceed 5 cwt.

In Somersetshire, last spring, a very successful scheme* was carried out by means of which nearly 200 tons of Scotch seed potatoes were distributed in lots of 5 cwt. or under to growers

* See the present *Journal*, pp. 970 and 1015.

throughout the county. Similar schemes were adopted in Carnarvonshire and other counties with good results.

The essential preliminaries of schemes of this kind are: (1) the holding of local meetings of those interested for the purpose of appointing a correspondent to collect orders and forward them to the officer nominated by the War Agricultural Committee to act on behalf of the county; (2) the selection of varieties. As a rule the choice should not exceed two or three sorts, otherwise the distribution becomes troublesome.

Local residents who wish to purchase should be invited to state the quantities needed, and the county officer will appoint a day by which all orders must be sent in, and will then complete the arrangements, and have the potatoes consigned to convenient stations.

All requests for information as to procedure should be addressed to the Secretary of the War Agricultural Committee of the county concerned.

NOTE.—The Seed Potato Order, 1916, is designed to ensure the supply of seed potatoes for 1917, and provides that no potatoes of "seed size" shall be used for any but seed purposes. Further, no persons other than authorised purchasers shall sell or buy seed potatoes, authorised purchasers being those who deal in potatoes in the course of their trade, or who in buying seed potatoes state in writing that such potatoes are to be used for seed purposes. Seed potatoes are defined in the Order, and vary with the origin and variety of potato. Copies of the Order may be obtained from the Secretary, Ministry of Food, Upper Grosvenor Street, London, W.*

The Culture of Early Potatoes under Glass.†

THE following notes have been prepared for the guidance of those who may desire to grow a crop of early potatoes under glass.

The following varieties are suitable:—

First Earlies.

Duke of York: a very early, kidney-shaped, yellow-fleshed variety.

May Queen and Ninetyfold: kidney-shaped and white-fleshed varieties.

Epicure and Early Puritan: round, white-fleshed varieties, the former being the heavier cropper of the two.

Sharpe's Express and Eclipse: kidney-shaped, white-fleshed varieties, very popular in some early potato districts. Eclipse is the later variety of the two, but the heavier cropper.

* The order is printed on p. 1013.

† This article is a reprint of Special Leaflet No. 69, copies of which will, therefore, not be sent to subscribers to the *Journal*.

Second Earlies.

Royal Kidney and Conquest: useful on heavy soils. The latter is a flat, round, white-fleshed variety and a heavy cropper.

British Queen: a strong grower of good quality and also a good cropper.

Soils and Manures.—Light or medium loams are to be preferred to heavy, stiff soils, although the latter may also be used.

The soil in the houses should be dug as deeply as possible without bringing up the subsoil. If the soil is very rich, or is deficient in lime, a dressing of lime at the rate of ½ lb. to 21 square yards may be applied with advantage.

Ordinary farmyard manure may be applied to average soils at the rate of 15 tons per acre (= two good barrow-loads per rod).

Sulphate of ammonia, bone meal, or superphosphate, are suitable artificial manures.

The sulphate of ammonia may be applied at the rate of 1½ lb. per rod, and the bone meal or superphosphate at the rate of 3½ lb. per rod.

Potash cannot be obtained at present, but any wood or plant ash which may be available should be applied.

Preparations for Planting.—The potatoes to be used as seed should be placed in boxes or trays with the crown end uppermost. A compost consisting of leaf mould, spent hops or ordinary soil mixed with some old well-decayed manure, should be worked into the interspaces between the sets and over the top.

The boxes should then be placed in a glass-house or frame where a night temperature of 50° to 55° F. can be maintained.

The soil should be moistened with tepid water, and then be shaded with bags or other suitable material for a few days. When the potatoes have begun to sprout the shading material should be removed and the sprouts on each set reduced to two at the crown end.

The leaf mould or soil will have the effect of encouraging the formation of white rootlets from the base of the sprouts, and care should be taken not to damage these in planting.

Distances to Plant.—If the whole of the house can be devoted to the crop, the potatoes may be planted 12 in. apart in the rows and 12 in. between the rows; where it is desired

to plant tomatoes before the potatoes are lifted, the distance between the rows should be 20 to 22 in. and between the sets 6 in.

If possible, the seed should be average 2-oz. seed, or larger, but it may be that smaller seed will have to be used. From 15 to 22 cwt. of seed per acre (10 to 15 lb. per rod) will be required.

If the seed has been well ripened it is advisable to cut a small portion from the base of the set immediately before planting. This ensures the decay of the seed, and seed tubers which decay after giving rise to plants usually produce stronger plants than seed tubers which do not decay.

The rows may be made to run the length of the house or across, to suit the piping.

The usual depth to plant is from 3 to 4 in. A trench should be made, the manures applied, and the sets planted and covered over with some specially prepared soil. Old partially exhausted potting soil is very useful for the purpose.

Watering.—The usual custom is to saturate the soil thoroughly some days before planting. When it becomes workable the sets should be planted at once, and no further water should be given until the soil shows unmistakable signs of dryness. Heavy waterings should not be given, but just sufficient to enable the tubers to swell. The water should be applied in the morning to allow as much of the moisture as possible to escape before closing the houses for the night.

Ventilation should be given on every suitable opportunity. A night temperature of 50° to 55° F. should be aimed at, with a rise during the day to 60° to 65° F. with sun heat. Later, in, spring, these temperatures will naturally rise with strong sun heat, but as much air as possible should be given during the day, to avoid a close, humid atmosphere inside the houses. Potato disease is very seldom troublesome and no spraying is necessary.

General Cultivation.—The soil between the plants and rows should be kept as loose and friable as possible, and the stems should be earthed up as the plants grow; this encourages tuber production, helps the drainage and supports the haulm.

The Selection of Wheats for Spring Sowing.*

IN the national interest it is of the greatest importance that the wheat harvest of 1917 should be as large as possible. So far, unfavourable weather and scarcity of labour have defeated the farmer's best efforts to attain this end by sowing winter wheat. It remains for him, therefore, to endeavour by every means at his disposal to make good the arrears by spring sowing.

As a rule, both soil and weather conditions are unfavourable during January, and the operations have to be delayed until February. If sowing can be done early in the month the loss of a week or two of the winter is not very serious, as the rate of germination is very slow during cold weather. If, however, the sowing of the crop cannot be carried out before the middle of February, some consideration must be given to the variety of wheat which is to be sown. Up to that date it is reasonably safe to sow any of the ordinary autumn wheats. A week or so later such a course is decidedly risky; it may result in a moderate, but late, crop, or it may fail to produce any crop at all. The plants may grow vigorously throughout the spring, but, instead of coming into ear at the end of May or in June, they may continue to produce quantities of leaves, and either no ears at all or far too few to yield a paying crop.

It is impossible to state precisely the date before which any given variety must be planted in order to prevent the crop from "running." It probably varies with climatic conditions as well as with the kind of wheat sown. It is well known that a slow-maturing wheat, such as Rivett's, requires to be planted at an earlier date than a moderately rapid-maturing wheat such as Square Head's Master, whilst a fast-growing wheat such as Nursery may safely be sown at a still later date. Judging from recent experience two of the safest of the autumn wheats for sowing up to the end of February are Square Head's Master and Little Joss. Indeed, both of these have been sown on several occasions in March with satisfactory results. Such a course entails a considerable amount of risk, and it cannot be generally recommended. For March sowing, or even for sowing after mid-February, one of the rapidly-maturing spring wheats is more suitable. Some of these, especially if sown early in the year, yield as well as the late-sown autumn wheats, and the crops can generally be harvested at about the usual dates. Further, they can, if necessary, be sown still later in the season. One or two

* This article is the re-written form, January, 1917, of Special Leaflet No. 49, copies of which may be obtained gratis and post free on application.

may be planted in the first half of April with the certainty of securing a crop, though very late sowing means some delay in harvesting and usually a small yield.

The Supply of Seed of Spring Wheats.—Unfortunately the home-grown seed supply of spring wheats is likely to be short. Whilst, therefore, it is desirable that farmers should make sure of at least a proportion of spring wheat, they should lose no opportunity of sowing up to the middle of February as large an area as possible of the earliest autumn wheats, and in this connection *Little Joss* is specially worthy of attention. Imported wheat may be used in case suitable English sorts are not available—see the section on Red Fife below.

Varieties of Wheat for Spring Sowing.—The varieties of wheat especially suitable for sowing after the middle of February are Dreadnought, Red Marvel, Nursery, Red Fife, Burgoyne's Fife, Marquis, April or April Bearded. Some of these may be sown, with a reasonable certainty of securing a crop, as late as the end of April.

Dreadnought (Hâtif Inversable), a wheat of French origin, is suitable for sowing not later than the end of February. It has relatively short, strong straw, which fits it admirably for sowing on rich, deep land. The ear is large and dense and the grain is of medium quality.

Red Marvel, also known as *Red Admiral*, is, like Dreadnought, a variety imported some years ago from France, where it is grown under the name of Japhet. It is a valuable wheat for spring sowing, but as a rule it should not be planted later than the middle of March.

The ears are fairly large, somewhat lax, beardless, and of a dull white colour; the grain is red and somewhat poor in quality. The straw bends over as the crop matures and it is frequently discoloured and soft owing to the readiness with which the plants are attacked by rust. In spite of these obvious faults the variety can be recommended on account of its large crops of grain. These, from early sowings, may almost equal those of the autumn-sown wheats, but any delay in sowing is followed by a very marked diminution in the yield.

Nursery Wheat is an old English variety suitable either for autumn or spring sowing. It can usually be counted upon to ripen satisfactorily if sown before mid-April, but it is not so reliable for extremely late sowing as April Bearded. When sowings can be made in March it should be chosen in preference to April Bearded, as it usually produces a better crop.

The ears are broad, moderately dense and well set, with a

pale, beardless chaff; the grain is red and of better quality than that of most of our wheats. The supply of seed is very short.

Burgoyne's Fife, Red Fife and *Marquis* form a group of wheats particularly suitable for spring sowing in districts where wheat of this type is known to do well. The grain is of high quality.

Red Fife.—There is a small stock of this variety grown in England in 1916; but considerable quantities are still being imported from Canada, and, as this season's supply of English grown seed wheat suitable for spring sowing is so low, it may be necessary to use imported seed on a considerable scale in order to bring the area under wheat to the same level as that of last year. Most of the wheats now being imported are early maturing varieties, which, if sown in the spring, would ripen in August. But various features make them unsuitable for cultivation in this country. Many of them are so susceptible to the common yellow rust that, in the event of an epidemic of ordinary severity, the crops would be more or less completely ruined. Others yield so badly that their cultivation cannot be recommended even as an emergency measure. A notable exception is provided by one of the wheats imported from Canada under the name of Manitoban wheat. The better grades of this consist almost entirely of a variety of European origin known as Red Fife. Fortunately this wheat has been tested on a large scale for the last fifteen years both by the National Association of British and Irish Millers and by the Department of Agriculture for Ireland. These trials show that whilst Red Fife may be used for autumn sowing it is particularly well adapted for spring planting on account of the rapidity with which it grows and matures its grain. If sown in the autumn it usually ripens ten days or so ahead of the ordinary English wheats, whilst sowings made in the spring, up to about the middle of March, will generally mature at the usual harvest dates. Later sowings still are practicable. For example, one case is on record where a 40-bush. crop resulted from a sowing made as late as 19th April. This crop was cut on 31st August and carried on 7th September.

There is thus a wide margin for planting in the case of this particular variety. Judging, however, from a long series of trials, the best results are obtained from sowings made between the middle and the end of February.

In many respects Red Fife is unlike the wheats usually grown in this country. Its ears are small and narrow, so that a standing crop usually appears to an observer accustomed only to ordinary English wheats to be a poor one. But the plants tiller unusually

freely from spring wheats, and when the ricks are threshed the yield per acre is often found to be double the amount anticipated.

The grain, too, is small and almost invariably hard and translucent. These small grains weigh well, with the result that the weight per bush. is usually 2 lb. or 3 lb. greater than that of our autumn-sown varieties. Moreover, in quality the grain is so markedly better than that of other home-grown wheats that in normal times it usually commands an extra 3*s.* or 4*s.* per qr.

The straw of this variety is distinctly more slender than that of most of our wheats, but it stands very fairly even in bad weather, possibly because it does not carry much flag. When cut it is generally bright and clean, and weighs well for its bulk, but if cut over-ripe it has a tendency to become rather brittle and to break if threshing is carried out under dry atmospheric conditions.

It is impossible from existing data to state definitely what the average yield of spring-sown Red Fife will amount to per acre. The figures naturally vary with the date of sowing, being higher as a rule for the earlier plantings. Records show that from the sowings made between the beginning of February and the end of April the best crop obtained was about 50 bush. per acre, and the worst about 20. Possibly an average yield of from 28 to 30 bush. would be a fair estimate for a normal season. If the lower figure is taken a crop of this order would yield a weight of grain almost exactly equal to that of an average crop of barley.

For spring sowing at least 3 bush. of seed should be used per acre. A higher seed rate has been used experimentally, but it is questionable whether it is necessary in practice, for, on account of the size of the grains, a bushel contains, roughly, one-fifth as many more seeds as a bushel of such a wheat as Square Head's Master. Sowings of less than 3 bush. per acre are not advisable, for they result in a more widely spaced crop with an increased susceptibility to the attacks of yellow rust. On the other hand, thicker sowings lessen the chances of a serious rust attack, but the resulting crop is usually too slender in the straw to stand satisfactorily if nitrogenous manures are used on it.

Red Fife is somewhat capricious in its likes and dislikes for various types of soil, and though so many tests have been made it is still impossible to be certain where the variety will succeed and where it will fail. But there is no doubt that the variety is best suited by comparatively light soils. Indeed, some of the best crops recorded have been obtained on land generally considered more suitable for barley than for wheat. On good loamy

soils it is usually satisfactory also, but on heavy clay soils or on land liable to be wet for considerable periods it is uncertain.

Burgoyne's Fife resembles Red Fife in its general appearance, but the straw is stiffer, the ears are usually a little larger, and the variety is, as a rule, a better cropper. The grain, however, is white in colour, and, though much better in quality than that of ordinary English wheats, it is not so "strong" as that of Red Fife. The variety is best sown early in the spring.

Marquis wheat is a recent importation from Canada which has been recommended for spring sowing. At present it has not been tested sufficiently in this country for any real opinion as to its value to be formed. In yielding capacity and in most other respects the variety is very similar to Red Fife, but it is capable of maturing in an even shorter period than that variety. The stocks grown in this country are far from pure, but as the "rogues" ripen at about the same period as Marquis the admixture is not particularly serious.

April, or *April Bearded*, is one of the most reliable wheats for late sowing. In most districts it may be sown with perfect safety up to the middle of April, and even when sown at so late a date the crop can be harvested soon after that of the autumn-sown wheats. Earlier sowing is advisable, however, in order to give the plants an opportunity to tiller more freely.

The ears of this variety are slender, lax and bearded, and red or reddish-grey in colour; the grain is red, and appears to be slightly better in quality than that of most English wheats. The straw is slender and rye-like, but rarely abundant, owing to the deficient tillering capacity of the plants.

In purchasing this variety it is as well to inquire for April Bearded wheat in order to prevent confusion with Red Marvel, which is occasionally substituted for it (see p. 980).

Only a few comparative trials of the yielding capacity of these various spring wheats have been made up to the present, but the returns so far obtained indicate that where wheats of the Fife class are known to succeed they should be sown in preference to any others. If there is any doubt on this point, Dreadnought should be chosen for the earliest sowings, say until the end of February, either Nursery or Red Marvel for sowing until the middle of March, whilst April Bearded, or, possibly, Marquis, should be selected for any later sowings.

Soil.—Any soil on which autumn-sown wheat will thrive will usually grow spring wheat satisfactorily, provided it is possible to obtain a reasonably clean, fine, mellow seed-bed which can be made fairly firm below. All cultural operations, therefore, should

be directed towards this end, the object being to secure quick, uniform germination and growth, since wheat sown in spring has a comparatively short period of growth. The best results will usually be obtained after a corn or root crop. In view of the weedy condition of some of the land at the present time special care should be taken in ploughing so as effectually to bury all surface vegetation. The use of disc coulters and "skims" in this connection might be far more general than it is. Drilling is usually to be preferred to broad-casting, but on a well-compacted, high-crested furrow broad-casting will give quite satisfactory results and will save time. After ploughing, if the furrow is fresh and loosely packed, the Cambridge or ring roller may be run over to consolidate the land, after which the harrow should be freely used so as still further to consolidate the bottom soil while leaving the top inch or two loose and fine. It will usually be found advisable to postpone the final rolling till the plant is up, for, in addition to further consolidating the soil and smoothing the surface, late rolling will have the effect of promoting tillering, in which spring wheats are deficient.

Manuring.—Unless the soil is very clean and highly fertile, it will, as a rule, be advisable to apply some artificial manure, with the two-fold object of encouraging growth and hastening maturity. A dressing of $\frac{3}{4}$ cwt. to $1\frac{1}{2}$ cwt. of sulphate of ammonia and 2 or 3 cwt. of superphosphate per acre will usually answer the purpose. Failing a sufficient supply of superphosphate, basic slag or a mixture of superphosphate and either steamed bone flour or Gafsa mineral phosphate may be used. The manure should be applied before the final harrowing. (Slag or mineral phosphate should not be mixed with sulphate of ammonia.)

Rate of Sowing.—Spring wheats must usually be sown a little thicker than autumn wheats. From 3 to 4 bushels per acre is the usual rate for drilling, and 4 to 5 bush. for broad-casting. As a rule, the earlier the sowing, the better the preparation of the seed-bed, and the richer the land, the less will be the quantity of seed required.

Spring Wheat as a Substitute for Oats or Barley.—Spring wheat is a strong competitor of spring barley, and may often be substituted for that crop, as, for instance, on strong land after roots. Further, it may be sown with advantage on land on which the oat crop has recently suffered severely from eel-worm ("tulip-root"), or frit fly.

NOTE.—In view of the fact that supplies of seed wheat of some varieties are very short, farmers are advised to make their purchases early.

Notes on Feeding Stuffs in January:
From the Animal Nutrition Institute, Cambridge University.

THE rise in the prices of feeding stuffs noted last month has continued, and prices have now reached an altogether unprecedented level. In these Notes for January, 1916, the average cost per unit of all the feeding stuffs quoted was 2*s.* 4*d.* The average cost of all the feeding stuffs quoted this month is 3*s.* 8*d.* per food unit, an increase during the year of 57 per cent. Bombay and Egyptian cotton cakes, rice meal, barley, oats, and peas now cost about 4*s.* 6*d.* per unit, an entirely prohibitive price. Most feeding stuffs cost between 3*s.*

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate Prices per ton at the end of December.					
		London.	Liverpool.	Hull.	Bristol.	Glasgow.	Leith.
		£ s. d.	£ s. d	£ s. d.	£ s. d.	£ s. d.	£ s.
Soya Bean Cake	122·3	17 15 0	—	—	18 0 0	—	—
Decorticated Cotton Cake ...	126·3	18 10 0	17 15 0	—	18 0 0	18 0 0	19 0
American Linseed Cake ...	119·0	—	—	—	—	—	—
Indian Linseed Cake	123·1	—	17 17 6	—	—	18 15 0	18 15
Russian Linseed Cake ...	123·5	—	—	—	—	—	—
English Linseed Cake... ...	120·1	20 0 0	20 0 0	18 7 6	19 15 0	20 0 0	19 0
Bombay Cotton Cake	65·3	15 10 0	15 10 0	—	—	—	15 15
Egyptian Cotton Cake ...	71·9	16 2 6	16 0 0	15 10 0	16 17 6	15 15 0	16 5
Coconut Cake	102·6	16 10 0	—	—	17 0 0	—	—
Palm Kernel Cake	96·1	15 15 0	15 0 0	—	15 7 6	—	‖13 10
Palm Kernel Meal (extracted)	92·5	—	—	—	—	—	—
Ground-nut Cake	145·2	19 0 0	—	—	18 12 6	17 15 0	—
English Beans	99·5	15 5 3	18 4 0	17 1 1	16 16 10	—	—
Bean Meal	99·5	—	—	—	—	18 5 0	—
Chinese Beans	101·2	16 6 8	16 11 4	—	—	—	—
English Maple Peas	97·2	20 0 0	—	23 6 8	—	—	—
English Dun Peas	97·2	17 6 8	—	21 2 3	—	—	—
Calcutta White Peas	97·5	17 15 6	—	—	—	—	—
American Maize	93·8	15 8 0	15 8 11	15 15 0	15 8 0	} 15 15 0	16 5
Argentine Maize	94·2	15 8 0	15 6 2	15 17 4	15 12 8	}	—
Maize Meal	86·5	17 10 0	16 10 0	17 2 6	16 15 0	16 12 0	17 0
Maize Gluten Feed	121·6	16 5 0	16 2 6	—	16 5 0	—	—
Maize Germ Meal	99·2	17 0 0	15 15 0	—	16 15 0	—	—
English Feeding Barley ...	83·0	19 12 0	—	18 4 0	—	—	—
English Oats	75·4	18 0 0	17 4 3	17 16 8	16 13 4	} 17 0 0	17 0
Argentine Oats	75·4	18 8 5	—	—	—	}	
Malt Culms	69·9	11 15 0	—	—	11 15 0	12 10 0	13 0
Brewers' Grains (dried) ...	84·5	*15 10 0 †14 10 0	—	11 5 0	14 15 0	13 7 6	13 0
Brewers' Grains (wet) ...	21·1	*1 17 0 †1 12 6	—	1 15 0	—	—	1 15
Distillery Mixed Grains (wet)	20·0	—	—	—	—	—	2 0
Distillers' Grains (dried) ...	101·2	15 10 0 15 15 0	12 10 0	—	15 5 0	13 10 0	13 7
Egyptian Rice Meal	78·7	17 0 0	—	—	—	} 16 10 0	—
Burmese Rice Meal	78·7	16 10 0	16 15 0	—	—	}	
Wheat Middlings (coarse) ...	94·8	16 0 0	—	15 10 0	—	17 0 0	15 10
Wheat Sharps	90·5	16 5 0	16 15 0	15 15 0	16 15 0	15 0 0	13 10
Wheat Pollards...	96·7	—	15 15 0	—	—	—	—
Wheat Bran	77·5	14 10 0	16 0 0	14 5 0	15 5 0	15 0 0	13 0
Wheat Bran (broad)	79·9	16 0 0	—	15 15 0	15 15 0	15 10 0	14 0
Feeding Treacle	60·0	13 10 0	15 10 0	—	—	14 10 0	15 0
Linseed	153·5	29 0 0	‡30 0 0	28 10 9	29 12 4	—	—
Linseed Oil	250·0	51 10 0	§58 0 0	51 10 0	—	—	—
Egyptian Cotton Seed... ...	108·6	20 0 0	—	20 5 0	—	—	—
Bombay Cotton Seed	99·6	—	—	—	—	—	—
Cotton Seed Oil	250·0	53 0 0	§60 0 0	—	—	—	—
Fish Meal	125·0	—	—	—	—	14 0 0	15 0
Locust Bean Meal	80·0	—	—	—	—	—	—

* Best ale } London. ‡ Cleaned. § In barrels.
† Porter } ‖ Carriage paid on 2-ton lots to any station.

and 4*s*. per unit. The only materials which are quoted under 3*s*. per unit are foreign linseed cake, soya bean cake, maize gluten feed, brewers' and distillers' grains, decorticated cotton cake, and ground nut cake, and there is difficulty in obtaining delivery of some of these.

In these circumstances it is imperative that farmers should fully consider their position, not only from the point of view of their own pocket, but from the standpoint of the supply of meat and milk for the nation, for the President of the Board has stated in Parliament that the country is in the position of a beleaguered city. The scarcity of feeding stuffs is urgently brought home to the farmer by their unprecedented price. It is the duty of everyone who is concerned in the production of meat and milk to do his utmost to produce from the limited supply of fodder which is available the greatest possible amount of human food.

It is impossible to conduct the business of a farm without horses, and many other businesses are like farming in this respect. Everyone, however, who keeps horses can do something to alleviate the position by reducing the consumption of oats to the lowest possible limit, using in their place other feeding stuffs which are less suitable for human food.

Of all the animals commonly used for meat production, the prime 30-months-old steer uses the greatest amount of fodder to make 1 lb. of meat. In the present state of the country the production of prime steer beef should be discontinued. Steers should be so fed as to give not more than 54 per cent. carcass weight. Killed at this stage they make perfectly palatable beef, which sells at a good price, and the wasteful finishing process is avoided. What is wanted now is quantity, rather than quality. The roots saved by shortening the fattening period should be used for fattening pigs, which give more human food for every pound of food they eat than any other animal, except a good milking cow. Great economy of fodder will result from fattening off steers at a much younger age than is the general custom. The following figures illustrate this point. A 12-months-old steer in 20 weeks, on an average daily ration of 5 lb. of concentrated food, 11 lb. of hay, straw and chop, and 30 lb. of roots, will put on a stone of live-weight increase per week. To obtain the same result with a 30-months steer, the average daily ration for 20 weeks must be 8 lb. of concentrated food, 11 lb. of hay, straw and chop, and 60 lb. of roots. Working out these figures on the basis of the dry matter contained in the fodder, and allowing for the larger percentage of carcass weight obtained

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	7½	Wheat sharps	3	7
Ground nut cake ..	2	7½	Calcutta white peas ..	3	7¾
Maize gluten feed ..	2	8¼	Egyptian cotton seed ..	3	8¼
Soya bean cake	2	10¾	Wheat bran	3	9
Decorticated cotton cake	2	11	Linseed	3	9½
English beans	3	0¾	Wheat bran (broad) ..	4	0
Distillers' grains (dried)	3	1	Maize meal	4	0½
Coconut cake	3	2½	English maple peas ..	4	1½
Chinese beans	3	2¾	Linseed oil	4	1½
Argentine maize	3	3½	Burmese rice meal ..	4	2½
Palm kernel cake ..	3	3½	Cotton seed oil	4	3
American maize	3	3½	Egyptian rice meal ..	4	4
English linseed cake ..	3	4	Egyptian cotton cake ..	4	5¾
Malt culms	3	4½	Feeding treacle	4	6
Wheat middlings ..	3	4½	English feeding barley ..	4	8¾
Maize germ meal ..	3	5¼	Bombay cotton cake ..	4	8¾
Brewers' grains (dried) ..	3	6½	English oats	4	9¼
English dun peas ..	3	6¾	Argentine oats	4	10½

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Distillers' grains (dried) ..	2	5¾	Wheat sharps	3	8¾
Maize gluten feed ..	2	8	Maize meal	3	9¾
Decorticated cotton cake	2	9½	Linseed	3	11
Indian linseed cake ..	2	10¾	Wheat bran	4	1½
Palm kernel cake ..	3	1½	Burmese rice meal ..	4	3¼
Maize germ meal ..	3	2¼	Egyptian cotton cake ..	4	5½
Argentine maize	3	3	English oats	4	6¾
Wheat pollards	3	3	Linseed oil	4	7¾
Chinese beans	3	3½	Bombay cotton cake ..	4	8½
American maize	3	3½	Cotton seed oil	4	8½
English linseed cake ..	3	4	Feeding treacle	5	2
English beans	3	8			

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Egyptian cotton seed ..	3	8¾
Brewers' grains (dried) ..	2	8	Maize meal	3	11½
English linseed cake ..	3	0¾	Wheat bran (broad) ..	3	11½
Wheat middlings ..	3	3¼	Linseed oil	4	1½
Argentine maize.. ..	3	4½	Egyptian cotton cake ..	4	3¾
American maize	3	4½	English dun peas ..	4	4½
English beans	3	5¼	English feeding barley ..	4	4¾
Wheat sharps	3	6	English oats	4	8½
Wheat bran	3	8¼	English maple peas ..	4	9½
Linseed	3	8¾			

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	2	6¾	Malt culms	3	4½
Maize gluten feed ..	2	8¼	English beans	3	4¾
Decorticated cotton cake	2	10¼	Brewers' grains (dried) ..	3	5¾
Soya bean cake	2	11¼	Wheat sharps	3	8¾
Distillers' grains (dried) ..	3	0¼	Linseed	3	10¼
Palm kernel cake	3	2½	Maize meal	3	10½
American maize	3	3½	Wheat bran	3	11¼
English linseed cake ..	3	3½	Wheat bran (broad) ..	3	11½
Coconut cake	3	3¾	English oats	4	5½
Argentine maize ..	3	3¾	Egyptian cotton cake ..	4	8½
Maize germ meal ..	3	4½			

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

LONDON, LIVERPOOL, HULL AND BRISTOL.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	7¾	Wheat sharps	3	7½
Ground nut cake ..	2	7	Calcutta white peas ..	3	7¾
Maize gluten feed ..	2	8¼	Egyptian cotton seed ..	3	8½
Decorticated cotton cake	2	10¼	Linseed	3	10
Distillers' grains (dried)	2	10¼	Wheat bran	3	10½
Indian linseed cake ..	2	10¾	Maize meal	3	11
Soya bean cake	2	11	English dun peas ..	3	11½
Palm kernel cake ..	3	2½	Wheat bran (broad) ..	3	11¾
Brewers' grains (dried) ..	3	2¾	Burmese rice meal ..	4	3
English linseed cake ..	3	3	Linseed oil	4	3½
Coconut cake	3	3	Egyptian rice meal ..	4	4
Wheat pollards	3	3	English maple peas ..	4	5½
Chinese beans	3	3	Egyptian cotton cake ..	4	5¾
Argentine maize	3	3¾	Cotton seed oil	4	6¼
Wheat middlings ..	3	3¾	English feeding barley ..	4	6¼
American maize	3	4	English oats	4	7½
Maize germ meal	3	4	Bombay cotton cake ..	4	8¾
Malt culms	3	4½	Feeding treacle	4	10¾
English beans	3	4¾	Argentine oats	4	10½

TABLE VII.

GLASGOW. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Fish meal	2	3	Wheat middlings ..	3	7
Ground nut cake ..	2	5¼	Bean meal	3	8
Distillers' grains (dried) ..	2	8	Maize meal	3	10
Decorticated cotton cake	2	10¼	Wheat bran	3	10½
Indian linseed cake ..	3	0½	Wheat bran (broad) ..	3	10½
Brewers' grains (dried) ..	3	2	Rice meal	4	2½
Wheat sharps	3	4	Egyptian cotton cake ..	4	4¾
English linseed cake ..	3	4	Oats	4	6
Maize	3	4¼	Feeding treacle	4	10
Malt culms	3	7			

TABLE VIII.

LEITH. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Wheat middlings ..	3	3¼
Distillers' grains (wet) ..	2	0	Wheat bran	3	4¾
Fish meal	2	5	Maize	3	5½
Distillers' grains (dried)..	2	7¾	Wheat bran (broad) ..	3	6
Palm kernel cake ..	2	9½	Malt culms	3	8¾
Wheat sharps	2	11¾	Maize meal	3	11¼
Decorticated cotton cake	3	0	Oats	4	6
Indian linseed cake ..	3	0½	Egyptian cotton cake ..	4	6¼
Brewers' grains (dried) ..	3	1	Bombay cotton cake ..	4	9¾
English linseed cake ..	3	2	Feeding treacle	5	0

TABLE IX.

AVERAGE PRICES PER FOOD UNIT.

GLASGOW AND LEITH.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Wheat middlings ..	3	5
Distillers' grains (wet) ..	2	0	Wheat bran..	3	7¼
Fish meal..	2	4	Malt culms	3	8
Ground nut cake ..	2	5¼	Bean meal	3	8
Distillers' grains (dried)..	2	8	Wheat bran (broad) ..	3	8¼
Palm kernel cake ..	2	9½	Maize meal	3	10¾
Decorticated cotton cake	2	11	Rice meal	4	2½
Indian linseed cake ..	3	0½	Egyptian cotton cake ..	4	5½
Wheat sharps	3	1½	Oats	4	6
Brewers' grains (dried) ..	3	1¼	Bombay cotton cake ..	4	9¾
English linseed cake ..	3	3	Feeding treacle	4	11
Maize	3	5			

from the older animal, the 12-months-old steer makes 1 lb. of beef from 16 lb. of dry matter of fodder, while the older animal requires 20 lb. to make the same amount of beef.

By adopting the general suggestions made above farmers will produce more meat from the limited supply of fodder at their disposal. At the same time, the saving of expensive concentrated feeding stuffs will result in a gain to their own pockets.

The following rations are intended to show how these general principles may be put into practice :—

Horses.—Rations were given last month both for farm horses and for nags and ponies kept in towns. In spite of the general rise in prices, there is no reason to change these rations. They may be used with full confidence that horses will work well and keep in health on them, and their use will effect a not inconsiderable saving in the cost of horse corn. At the same time those who use them will have the satisfaction of knowing that

they are sparing oats which may be urgently wanted to feed the people. An exception should be made in the case of in-foal mares, which should still get their normal ration of oats.

Cows.—Rations for milch cows were given in October and November. It does not seem possible to improve on these rations, where the foods of which they were composed can be bought. In view, however, of the difficulty of buying some of these foods—for instance, ground nut cake and palm kernel cake—it seems desirable to give an alternative ration this month. As an addition to a normal ration of coarse fodder, 2 lb. of

TABLE X.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0·8	45·2	6·3	21·1	77·5	102
Soya bean cake	1 : 1·1	34·0	6·5	21·0	66·7	88
Decort. cotton cake ..	1 : 1·2	34·0	8·5	20·0	71·0	93
Linseed cake Indian ..	1 : 1·9	27·8	9·3	30·1	77·1	101
Linseed cake, English ..	1 : 2·0	26·7	9·3	30·1	76·0	100
Cotton cake, Egyptian ..	1 : 2·1	15·5	5·3	20·0	40·0	53
Cotton cake, Bombay ..	1 : 2·5	13·1	4·4	21·5	37·6	49
Distillers' grains	1 : 2·9	18·7	10·2	29·0	57·3	75
Maize gluten feed	1 : 3·0	20·4	8·8	48·4	87·4	115
Brewers' grains, dried ..	1 : 3·5	14·1	6·6	32·7	50·3	66
Coconut cake	1 : 3·8	16·3	8·2	41·4	76·5	101
Palm kernel cake	1 : 4·5	14·1	6·1	48·9	76·7	101
Linseed	1 : 5·9	18·1	34·7	20·1	119·2	157
Bombay cotton seed ..	1 : 6·6	11·0	16·8	30·1	77·5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8·5	9·0	6·2	61·2	81·0	107
Rice meal	1 : 9·4	6·8	10·2	38·2	68·4	90
Rich in Protein, Poor in Oil.						
Fish meal	1 : 0·1	54·0	2·0	—	56·0	74
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	66·9	88
Beans, English	1 : 2·6	19·3	1·2	48·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	47·9	67·0	88
Peas, English maple ..	1 : 3·1	17·0	1·0	50·0	70·0	92
Palm-nut meal (extracted)	1 : 3·4	15·6	1·9	48·7	66·1	87
Brewers' grains, wet ..	1 : 3·5	3·5	1·5	8·6	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·6	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8·0	8·0	2·1	57·8	67·9	89
Oats, English	1 : 8·0	7·2	4·0	47·4	59·7	79
Oats, Argentine	1 : 8·0	7·2	4·0	47·4	59·7	79
Maize, American	1 : 11·5	6·7	4·5	65·8	81·0	107
Maize, Argentine	1 : 11·3	6·8	4·5	65·8	83·5	110
Maize meal	1 : 13·0	5·5	3·5	63·9	77·8	102
Wheat middlings	1 : 4·8	12·8	4·1	52·3	73·1	96
Wheat sharps	1 : 5·1	11·6	3·4	51·6	62·0	80
Wheat pollards	1 : 4·5	13·6	3·7	52·5	62·1	82
Wheat bran	1 : 4·7	11·3	3·0	45·0	49·7	65
Wheat bran, broad ..	1 : 4·7	11·3	3·0	45·4	48·1	63
Locust bean meal ..	1 : 22·1	4·0	0·7	69·2	71·4	94

decorticated cotton cake and 3 lb. of maize gluten feed make an economical allowance of concentrated food at present prices for a 10-cwt. cow giving 2 gal. of milk. A larger cow will require more. For every extra gal. of milk it is necessary to give an extra 2 lb. of the same mixture and to increase the root ration by about 7 lb.

Cattle Fattening for Beef.—The only change in the rations suggested last month is that where ground nut cake cannot be obtained decorticated cotton cake should be substituted for it.

Young Stock.—Linseed and maize this month are as cheap as any of the foods suitable for young stock. If ground together in the proportion of 1 part of linseed to 5 or 6 parts of maize, an excellent mixture is obtained, which may be fed with bran or dried grains or malt culms to increase the proportion of bone-forming material.

Ewes with Lambs.—Notwithstanding the high price of feeding stuffs, it is advisable to feed ewes and lambs fairly well, because they will convert into human food a quantity of fodder which would otherwise not be used. Young lambs, too, are fairly economical converters of fodder into flesh. The following is an economical and suitable mixture:—

Linseed cake	2 parts.	Malt culms	1 part.
Dried grains......	1 part.	Beans	2 parts.

It should be used as follows: For ewes with single lambs, $\frac{3}{4}$ lb. per ewe, rising to 1 lb.; the lambs, as soon as they eat well, should get 2 oz. per head through creeps, and as their ration is increased up to 1 lb. the ewe's ration should be reduced. For ewes with double lambs the ration should be $\frac{1}{4}$ lb. greater until the lambs begin to eat; as soon as a separate feed is put through creeps for the lambs they should get 2 oz. per head, and as this is increased the ewe's ration should be reduced.

Pigs.—The cheapest feed for young store pigs just weaned, from 8 weeks old to 16 weeks old, is a mixture of 3 parts of wheat middlings and 1 part of maize gluten feed. At present prices 4 lb. of this mixture costs $7\frac{1}{2}d$. Fed to such pigs, it will give, on the average, 1 lb. of live weight increase, worth $9d$. Older pigs above 16 weeks old can be fattened on roots and maize gluten feed, as explained last month, and this is the cheapest way of producing fat pigs at present prices. Later in the year it is likely that roots may be replaced by grass or green fodder.

Feeding of Poultry: *From the Harper Adams Agricultural College, Newport, Salop.*

THE very great rise in the price of all poultry foods makes it imperative to select those foodstuffs which are the least expensive, but which can be relied upon as giving the best returns for egg-production. It is very doubtful economy to reduce the amount of food in order to save 1*d.* per head per week, for such a reduction, especially at this time of year, when birds are so dependent on purchased foods, will almost certainly be followed by a diminution in the number of eggs produced. With eggs selling at 3*d.* or 4*d.* each, the loss of one egg per week considerably outweighs the small saving in food.

Economy in feeding must be sought in other ways than by reducing the quantity given to birds in full lay. Careful observation of the individual birds of the flock will make it possible to reduce the food bill, for there are few flocks which do not contain some birds which may be separated out and treated apart. Those pullets which have not commenced to lay may be kept together and fed accordingly, while wasters of any kind and birds in ill-health should be watched for as consuming food with unprofitable results.

The prices of the principal poultry foods on 1st January, 1917, were as follows :—

Food.	*Price per cwt.*		*Food.*	*Price per cwt.*	
	s.	*d.*		*s.*	*d.*
†Wheat	18	0	Bran	16	6
Oats	18	6	Rice meal	18	0
Cracked maize ..	18	6	Biscuit meal	24	9
Cracked peas	19	0	Clover meal	12	6
*Dari	18	0	Fish meal	20	6
Thirds	18	0	Soya bean meal ..	18	6

* Not procurable, and priced the same as wheat.

The system of feeding adopted with very satisfactory results in the College poultry laying trials is as follows :—

1st Feed (early morning)	Grain in litter.
2nd ,, (mid-day)	Mash in troughs.
3rd ,, (afternoon)	Grain in litter.

The grain fed in the morning consists of :—

Oats	2 parts.	Crushed peas	1 part.
Crushed maize ..	1 part.		

The afternoon mixture consists of :—

†Wheat	2 parts.	Dari	2 parts.

† The feeding of wheat (except tailings, screenings or damaged wheat) to poultry is prohibited by a Food Control Order (see p. 1006).

The mash includes the following :—

Sharps	4 parts.	Fish meal	1 part.
Bran............	1 part.	Clover meal	½ ,,
Biscuit meal	1 ,,	Vegetables	*ad lib.*

The biscuit, fish, and clover meals are scalded, and after being well swollen with sufficient moisture the mixture is dried off with sharps and bran into a moist, crumbly condition, in which it is fed.

The total amount of food per head per day varies from 3½ to 4½ oz. according to the condition of the birds, their egg-production and the amount of vegetables which is available. On the basis of the prices given for 1st January the cost of the above ration works out at 3½*d*. per head per week.

Fish meal has recently been difficult to obtain owing to the shortage of supply, due in part to the stormy weather during the autumn months, and in part to the fact that so many of our fishermen are engaged in mine-sweeping.

Sharps and bran have been scarce, and it is possible that the new milling regulations with regard to wheat and flour will mean that another form of food must be sought for poultry. Rice meal, if clean and of fair quality, may be used partly to replace sharps.

Notes on Manures in January:
From the Rothamsted Experimental Station.

IN the coming season the fertiliser problem will be complicated by the fact that superphosphate will not be available in the usual quantities, and consequently steps must be taken to meet the shortage.

No superphosphate should be used on grass land. Basic slag has proved to be at least as good, and in many cases better; and it is at present considerably cheaper. While it can go on late in certain circumstances it is always safest to apply it early, and under present conditions orders ought to be placed as early as possible.

There is a further reason why basic slag should be largely used on grass land. Experiments all over the country have shown that a dressing of basic slag improves the feeding value of the herbage so much that less cake is necessary.

The best known comparison of basic slag and feeding cake is that made at Cockle Park, where the live weight increases in the sheep reckoned as lb. per acre per annum were :—

	No Cake, No Manure.	*Decorticated Cake,* No Manure.*	*No Cake, Basic Slag (10 cwt. in 1897 and 1905).*
	Plot 6.	*Plot 1.*	*Plot 3.*
First nine years, 1897-1905	37	106·7	117
Increase due to manuring	—	69·7	80
Second six years, 1906-1911	23	42·5	117
Increase due to manuring	—	19·5	94

* 597 lb. cake per acre in 1897-8, in 1903 and 1904.

Spring Dressings for Cereal Crops.—Farmers who propose to use spring dressings should order early to ensure getting supplies in time. The wisdom of this course has been shown repeatedly during the War, and some of the more far-seeing farmers have already got their supplies in hand. In calculating the amount of spring dressings needed it will be well to allow 1 cwt. of sulphate of ammonia per acre for all corn crops following another corn crop, and ½ cwt. per acre for all following root and clover crops. It is possible that some of the corn after roots and clover may need no help, but, on the other hand, some of the corn coming after corn may need more than 1 cwt. of sulphate of ammonia.

A common mistake in dealing with spring dressings is to put them on too late. In the old days, when wheat was at 30*s.* or thereabouts, the farmer would only use a spring dressing when he felt it was absolutely necessary, and he could then apply nitrate of soda with reasonable prospect of getting a good result. Nowadays, however, with wheat at 60*s.* and other cereals correspondingly high, spring dressings should be a regular feature of cereal husbandry, and they should go on early so as to give them time to produce their best effect. Everything should be in readiness, therefore, to apply them at an early opportunity.

No spring dressing is likely to act, however, if the crop has lain water-logged during part of the winter. Wherever this seems likely to happen a way out should be found for the water, even at the risk of considerable trouble and inconvenience. Water-logged patches mean loss of crop and manure, and the encouragement of masses of weeds which shed their seed all round and add considerably to the difficulties of cleaning later on. On the other hand removal of the water by a water furrow, a sumpf pit, or other means, allows proper growth of crop, and therefore gives value for the manure expended, besides tending to keep down weeds.

In some places the seeds ley is doing badly owing to failure of the clover. If rye-grass is sown and seems likely to succeed

the ley may be left, but if clover alone has been sown the farmer should seriously consider whether he should not plough it up. If he leaves it he is likely to get considerable growth of weeds where the clover fails, and this would not only lower the value of the clover hay, but, as stated above, add to his difficulties next year. If he ploughs up he can still put in wheat, semi-winter or spring oats, or barley, and obtain considerable benefit from the residues left by the dying clover roots. This is a question for individual consideration, but it touches the manuring of the farm in this way: Failure of clover is often associated with lack of lime, and careful inspection should be made now with a view to deciding what fields need lime or chalk. If at all possible this should be applied where necessary. Where clover is failing this year steps should be taken to ensure next year's crop by dressing the land now with lime or limestone, or, if this is impossible, by applying basic slag later on. Ground limestone is now available in considerable quantities in the north.

A correspondent has raised the question whether basic slag alone is a sufficient fertiliser for roots. It is not—dung has always to be used. The combination of these two is sufficient in the southern parts of Britain, where root crops do not usually exceed some 13 or 14 tons to the acre. In the north, however, where climate allows of better growth, and where some 25 tons can be expected, it is often advantageous to give a top dressing of sulphate of ammonia in addition.

Unit Prices of Artificial Manures in January.—The statement on p. 996 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for January, 1917.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating, and rebagging the ingredients, bags, and loss of weight.

	England and Wales.										Scotland.	
	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.	Glasgow.	Leith.
Nitrogen from :	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Sulphate of Ammonia pure .. 95 %	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	—	15 6
Sulphate of Ammonia pure .. 93 %	—	—	—	—	—	—	—	—	—	—	—	—
Calcium Cyanamide (Nitrolim)	—	—	—	—	—	—	—	—	—	19 3½	—	—
Nitrate of Soda pure .. 95 %	—	—	25 9½	—	—	25 5	25 11½	—	24 10½	24 2½	—	23 10½
Nitrate of Soda pure .. 90 %	26 7	26 4	24 8	—	—	25 4	—	—	26 2	25 8	—	—
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—	—	—
Castor Meal	—	26 1½	24 5	—	—	—	—	—	—	—	—	—
Allowed for Insol. Phos.	—	*2 0*	*2 0*	—	—	—	—	—	—	—	—	—
Allowed for Potash ..	—	*15 0*	*15 0*	—	—	—	—	—	—	—	—	—
Soluble Phosphates from :												
Superphosphate 35 %	3 4½	2 10	3 6	3 9½	3 7½	3 7	3 6	3 5	—	—	3 8½	3 8½
" 33 %	3 3½	—	3 6½	—	—	3 6½	3 6	3 5	—	—	—	—
" 30 %	3 4	—	3 8	3 10	3 8	3 7	3 6	3 5	—	—	3 9	3 9
" 26 %	3 8	—	3 10	4 3	4 0½	3 11½	3 10	3 9	—	—	3 11¼	—
Dissolved Bones	5 1	—	5 1	5 2½	5 0½	5 3½	5 3½	5 2	5 1½	5 0½	—	—
Allowed for Nitrogen	*19 10½*	—	*19 11*	*20 5½*	*19 10*	*20 9*	*20 9½*	*20 3½*	*20 1½*	*19 9½*	—	—
Allowed for Insol. Phos.	*2 9½*	—	*2 10*	*2 10½*	*2 9½*	*2 11*	*2 11*	*2 10½*	*2 10*	*2 9½*	—	—
Insoluble Phosphates (Citric Soluble) from :												
Basic Slag	2 9½	2 8	2 6	—	—	2 4	—	—	2 2½	3 6	3 3½	3 0¾
Insoluble Phosphates from :												
Basic Slag	—	—	1 11½	1 11½	—	2 1	—	—	—	2 8½	2 7	2 5
Bone Meal	2 7½	—	—	2 10	2 9	2 9½	2 9½	2 6	3 0½	2 8	—	4 0
Allowed for Nitrogen	*18 8*	—	—	*20 0*	*19 6½*	*19 10*	*19 9*	*17 10*	*21 4*	*18 11*	—	*15 6*
Steamed Bone Flour ..	2 6½	2 8	2 8	2 6½	—	2 5½	—	2 3	2 7½	—	2 9	—
Allowed for Nitrogen	*18 0*	*19 1*	*18 9*	*18 0*	—	*17 4½*	—	*15 10*	*18 6½*	—	*15 6*	—
Fish Guano	—	3 8	2 11½	—	—	—	—	—	—	—		

Egg-Laying Record of White Leghorn Pullets*.

THE following egg-laying record of a flock of 750 White Leghorn pullets, bred, reared, housed, and fed by Mr. S. G. Hanson, has been communicated to the Board. The monthly price the eggs realised in London, wholesale, is also given, together with the amount allowed for feed. The latter figure is approximate, but fully covers all charges for feed, labour, fixed charges, and railway carriage. The pullets were hatched during April, May, and June, 1915, and the egg-laying record is from November, 1915, to October, 1916.

Month.	Year.	Eggs Laid.	Price per dozen, whole-sale.	—	—
				£ s. d.	
November	1915	698	2/9	8 0 6	Fractions of dozens not counted.
December	,,	5,393	3/2	71 10 2	
January ..	1916	10,831	2/5	108 19 10	
February ..	,,	13,078	1/9	95 5 9	Amount realised: £ s. d.
March ..	,,	16,384	1/6	102 7 6	981 18 0
April ..	,,	16,974	1/3	88 8 1	
May ..	,,	15,216	1/6	95 2 0	*Less* cost of feed, labour, railway carriage, upkeep of houses and yards, etc... .. 468 15 0
June ..	,,	13,064	1/9	95 4 0	
July ..	,,	12,901	1/11	103 0 5	
August ..	,,	10,790	2/3	101 2 3	
September	,,	7,066	2/8½	74 12 6	
October ..	,,	3,246	2/10	38 5 0	
		125,641		£981 18 0	£513 3 0
					Net Profit on flock of 750 Pullets: £513 3 0

	£	s.	d.
Average per bird—167½ Eggs.			
,, ,, realised in cash	1	6	2
Cost of feed, labour, railway carriage on eggs, fixed charges, etc., per bird	0	12	6
Profit per bird	£0	13	8

The following Note has been communicated to the Board by Mr. C. E. J. Walkey:—

Hot-beds for Small Holders.

On the greater number of small holdings dung is so much in demand for other purposes that little will be available for making hot-beds to grow ridge cucumbers and vegetable

* This account of the results obtained by Mr. S. G. Hanson is likely to interest large poultry keepers. The Board are in no way responsible for the

marrows. As both these vegetables are easily grown and usually command a ready sale, it may be useful to show how dung may to a great extent be dispensed with in their culture. A certain amount of dung will be necessary, as both cucumbers and marrows are gross feeders once they have started into growth; but the actual hot-bed on which the seedlings are raised need not be made of dung at all, but simply of freshly cut coarse grass, nettles, and long weeds. Before a satisfactory hot-bed can be made with these materials it is necessary to gain some experience in their use. If the beds become too hot the marrow seeds may be destroyed, while if insufficient heat is developed the seed may germinate so slowly that slugs or other pests may eat them, or they may rot. Careful attention should, therefore, be paid to the following directions.

If no dung can be obtained, a quantity of coarse, young grass from pastures and hedgerows, nettles, and weeds should be collected and piled up in a waste part of the garden, if possible in the shade. It should be borne in mind that, after heating, the fresh material will sink to at least half its original depth, and that unless this is allowed for the hot-bed may not be of sufficient depth to promote continued heating. The site for the hot-bed, which should also preferably be in a shady place, should then be deeply dug over at once, broken up fine on the top, *and made quite level*. When this has been done, the collected material should be carefully shaken out and placed over the levelled place in layers. The first layer should consist of coarse grass, the second of nettles, the third of grass—cut in shorter lengths than the first layer—and the last of nettles or weeds. Unless the material is thoroughly shaken apart and the layers put on quite evenly the bed will not heat properly. If made up in showery weather the whole heap may be left, but if there be no prospect of rain it must be well watered with soft water, or preferably with weak liquid manure.

Two days later the heap should be carefully turned over, being well shaken up in the process, and again well watered. When this has been done, well-shaken-out layers of green material in much the same order as at first should be added to the heap. After it has been allowed to heat for two days more it should be turned over as before. The whole should then be turned over a third time and shaken up, 6 to 8 in. of decayed manure being placed between the top and second layers with a sprinkling above of sifted earth, and then left to heat. In a day or so the hot-bed will be ready, but the heat should be tested before the seed pots can be sunk in the top. The easiest way to do this is to

take a fairly strong stick long enough to reach into the middle of the heap when inserted half-way down the side. The stick should be pushed in and left for a few moments. If, when withdrawn, the end inserted is not too hot to hold, planting may be proceeded with; otherwise, the heap must be left for another day, or longer if necessary, and again tested with the stick. The seed should be sown in 3-in. pots half filled with sandy loam, three seeds being allotted to each pot. Until the young plants are 1 in. high and are developing their second leaf the pots should be covered with a few loosely scattered leaves or blades of grass, or with a slate or tile. When the seedlings have reached this stage the pots should be taken off the heap on a fine morning and put in a warm corner while sufficient finely-sifted soil is added to the hot-bed for planting purposes. This soil should be rich and porous and should be not less than 4 in. in depth; double this depth will be better.

If a small amount of horse manure can be spared, a layer of this, both long and short, well shaken up together, should be placed on the ground below the first layer of grass, and also between each of the other layers. This will greatly improve the mixture when rotted down for another year's use.

In dry districts or on light soils the hot-bed is often best made in a pit. The top spit from the pit should be broken up fine and then may well be put upon the top for the after planting of the marrows. If a small amount of powdered poultry manure be thoroughly incorporated with this soil it will promote the growth of the plants. It should be noted, however, that rank growth is not desirable, or fruiting will be interfered with.

Note.—The manure taken from poultry houses should be spread weekly on the floor of a dry shed and turned from time to time to dry. When quite dry it should be broken up with a hammer or mallet and mixed with burnt earth and gypsum in the proportion of 1 part of gypsum, 3 parts of dry manure, and 7 of burnt earth. The whole should then be placed in a heap in the air for at least a month before use, and turned over twice. This compost is also of great value in the growing of any garden crop, either dug in or as a top dressing.

To plant the seedlings the pot should be held upside down in the left hand, with the fingers across the mouth to prevent the plants falling out. The pot should be tapped gently with the right hand or a trowel to loosen the soil within, and lifted clean off. A hole should be scooped out near the middle of the bed—if a very large hot-bed, half-way between the middle and the

outside of soil—and the ball of earth containing the plant inserted so that the top is slightly lower than the surrounding soil. The plants should be watered on planting and a little dry earth afterwards sprinkled round them. To afford protection against late frosts the plants should be covered for a night or so with the empty pot. If the hot-bed be very large, a second set of plants may be put in 1 yard apart. When well established, all but the strongest of each set may be pulled up and thrown away. If the plants make very strong growth, the extreme end of the branches may be nipped off once the fruit begins to set.

Model Allotment Gardens and Fruit Growing in Staffordshire.

THE Education Committee of the Staffordshire County Council have carried on demonstration allotments in various parts of the county for the past seven years. Beginning in 1910 with four model allotments, the number was raised in 1911 to six, and this number has since been maintained. The work carried on on these allotments includes variety trials of vegetables, demonstrations on the use of artificial manures, experimental investigations on horticultural points, and spraying demonstrations. Records of the results on each model allotment are kept, and before the War were annually published as a "Report on Model Allotments." To secure a further dissemination of the results obtained on the allotments, together with other information, the county instructors in horticulture deliver special lectures and pay many informal visits during the season.

An account of the allotment gardens in Stafford having been previously given in this *Journal* (August, 1916, p. 489), it may be of interest to describe the model garden in this group. In former years the allotment in question seems to have been worked under a close cropping system of rotation, but last year it was made more experimental. It is well managed, and devoted mainly to vegetables, viz., potatoes, onions, carrots, and haricot beans. The allotment is handled by one of the best growers, under the supervision of the county instructor in horticulture, Mr. J. Stoney, and there is no doubt that it serves a very good purpose. The need for such a model allotment is undoubted, some of the holders of the Stafford Freemen group of allotments having still very vague ideas on the use of artificial manures; and with regard to potato spraying, the need for co-operation (emphasised in the former note) for the purchase

and use of spraying apparatus is very evident. Probably, too, the benefits of good cultivation would be brought home to the allotment holders in a striking manner if one of the worst weed-infested plots could be taken and brought into a high state of cultivation.

With regard to fruit growing, there are great possibilities in many districts of Staffordshire, and the local markets are exceptionally good, as the demand exceeds the local supply. To mention only the immediate vicinity of Stafford, very good crops of small fruit can be grown; and, with proper attention to pruning, spraying, and feeding, very fair crops of apples could be obtained in many cases. A local fruit grower is at present extending the cultivation of strawberries, which succeed well in normal seasons; and this grower has found fruit-growing very remunerative in the suburbs of Stafford. At Haughton, about 4 miles away, excellent top fruit and small fruit can be grown.

The County Council have established fruit demonstration stations at five centres, and, in addition, some fruit is grown on the model allotments already described. Apples are grown on the Stafford plot, and the trees are in good condition. Besides ignorance of methods of cultivation and varieties on the part of the average allotment holder, however, pilfering seems to be feared in certain districts. Against this it must be pointed out that fruit allotments are quite successful in other parts of the country and that pilfering does not give serious trouble.

Provision of a Valuable Bull under the Board's Live Stock Scheme.

PARTICULARS which have come to the notice of the Board, of a very interesting case in connection with the sale of a young bull, show that the small farmers belonging to the Kimbolton and District Bull Society (Hereford) had a very useful Hereford bull provided for them under the Board's Live Stock Scheme in 1914-15 at a servic fee of 2*s*. 6*d*. This bull ("Titus," 31112) was calved on 28th April, 1913, was bred by Mr. A. P. Turner, The Leen, Pembridge, and was purchased by Mr. E. T. Cave, New House, Kimbolton, for 44 guineas. Mr. Cave provided the bull for the Kimbolton Bull Society from 18th June, 1914, until 17th June, 1915. It was then sold for export for £120, and afterwards re-sold in Argentina for £426.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

Varieties of Potatoes (*N. of Scotland Coll. of Agric., Leaflet No.* 51).—Nine varieties of potatoes were grown on a rich, sandy loam. The yields per acre were: Table Talk, 15 tons 9 cwt. 53 lb; Summit, 14 tons 4 cwt. 24 lb.; British Queen, 13 tons 6 cwt. 85 lb.; Dalhousie, 12 tons 19 cwt. 32 lb.; King George V., 12 tons 11 cwt. 63 lb.; Sharpe's Eclipse, 11 tons 16 cwt. 94 lb.; Arran Chief, 11 tons 15 cwt. 58 lb.; Shamrock, 10 tons 18 cwt. 26 lb.; and What's Wanted, 9 tons 11 cwt. 6 lb. Sharpe's Eclipse, British Queen, and Dalhousie showed traces of disease. The cooking quality of the potatoes was, on the whole, disappointing, with the exception of Sharpe's Eclipse and Arran Chief. Similar tests at three centres gave the following averages per acre: Lang's Imperial, 14 tons 1 cwt.; Rector, 12 tons 3 cwt.; Arran Chief, 11 tons 17 cwt.; Shamrock, 11 tons 12½ cwt.; Templar, 11 tons 6 cwt.; Arran Hope, 11 tons 4 cwt.; Summit, 11 tons 3 cwt.; Irish Queen, 10 tons 7½ cwt.; Bishop, 9 tons 6 cwt.; Arran Chief (second year growth), 8 tons 1 cwt.

Immature *versus* **Ripe Seed of Potatoes** (*Jour. Dept. Agric., Victoria*, August, 1916). The 1915-16 potato tests of the Victoria Department of Agriculture included at two centres a comparison of the yields of potatoes from ripe and immature seed.

At the first centre seven varieties were tested, and with each variety immature seed gave the higher yield, the increase varying from 1 ton to 3 tons 4 cwt. per acre, and the average increase being 1 ton 14½ cwt. The values of the increases per acre ranged from £5 to £16 and averaged £8 13*s*.

At the other centre only one variety was tried, the increase due to immature seed being 1 ton 56 lb.

Potatoes: Cut Sets *versus* **Whole Sets** (*N. of Scotland Coll. of Agric. Leaflet No.* 51).—This experiment was designed to compare the results obtained from planting cut sets of large size and uncut sets of medium size. The resulting yields per acre were: *Whole seed*—Summit, 14 tons 8 cwt.; Shamrock, 13 tons 10 cwt.; Arran Chief, 15 tons 4 cwt.; Rector, 15 tons 3 cwt.; Templar, 11 tons 1 cwt.; average equals 13 tons 17 cwt. *Cut seed*—Summit, 11 tons 7 cwt.; Shamrock, 11 tons 5 cwt.; Arran Chief, 12 tons 16 cwt.; Rector, 13 tons 1 cwt.; Templar, 11 tons 1 cwt.; average equals 11 tons 18 cwt. The results are wholly in favour of uncut sets.

Laying Competition at Harper Adams Agricultural College (*Harper Adams Agric. Coll., Bull. No.* 1, 1916).—In continuation of the Second Twelve Months Laying Competition at the Harper Adams Agricultural College, a full report of which appeared in this *Journal* for February, 1915, p. 1048, a third trial, under the same conditions as in 1913–14, was commenced on the 31st October, 1914. This trial extended over ten months only, and for the first time breed sections were arranged with the object of encouraging breeds other than the popular Wyandottes and Leghorns to be entered, and ultimately of developing in these breeds better egg-producing qualities. In previous years it had been the practice to allow owners to replace any bird that died during the period of the test, but during this trial owners of pens were allowed to send an extra bird when forwarding the competing birds. The practice was continued of allowing the score of the extra bird to be added to the original bird's figure from the time the latter bird was replaced.

Comparison of Number and Value of Eggs Laid by the different Breeds.—The following shows the average yield and value per bird of the eggs laid by each breed :—

Breed.	Number of Birds.	Average Yield per Bird for 10 Months.	
		Eggs.	Value.
			s. d.
White Leghorns	114	175·8	17 8½
White Wyandottes	90	167·5	17 5
Buff Orpingtons	36	160·2	16 7½
Barred Rocks	6	192·8	20 3
Rhode Island Reds	18	164·3	17 3¾
Sussex	30	155·8	16 4¾
Sussex Faverolles	6	145·6	13 11¾
All the Birds	300	168·54	17 3¼
Heavy Breeds	186	164·1	17 1
Light Breeds	114	175·8	17 8

It will be seen that, with the exception of the single pen of Barred Rocks, the only breed to surpass the total average was the Leghorns, while the Wyandottes and Rhode Island Reds followed very closely. The 114 Leghorns laid a total of 20,043 eggs valued at £100 15*s*. 6½*d*., *i.e.*, an average of 175·8 eggs per bird valued at 17*s*. 8¾*d*., during the ten months. The greatest number of eggs from any one pen was 1,302, and the lowest 897. The 90 White Wyandottes gave a total of 15,080 eggs, valued at £78 8*s*. 1¼*d*., *i.e.*, an average per bird of 167·5 eggs, valued at 17*s*. 5*d*.

Comparison with Former Results.—A comparison with the results of previous competitions is made in the following table :—

—	12 Months.		10 Months only.
	1912–13. 100 Pens.	1913–14. 50 Pens.	1914–15. 50 Pens.
Total number of eggs laid ..	91,115	56,184	50,562
Average number of eggs per pen	911·15	1123·6	1011·1
Average number of eggs per bird	151·9	187·28	168·5
Total value of eggs	£431 11*s*. 6*d*.	£285 9*s*. 3¼*d*.	£259 11*s*. 1¼*d*.
Average value of eggs per pen	£4 6*s*. 5*d*.	£5 14*s*. 2*d*.	£5 3*s*. 10*d*.
Average value of eggs per bird	14*s*. 5*d*.	19*s*. 0½*d*.	17*s*. 3¾*d*.
Best pen of birds: number of eggs	1,389	1,339	1,272
Best pen of birds: value of eggs	£7 0*s*. 3¼*d*.	£7 6*s*. 7¾*d*	£7
Worst pen of birds: number of eggs	526	613	748
Worst pen of birds: value of eggs	£2 7*s*. 3¾*d*.	£2 15*s*. 4½*d*.	£3 11*s*. 6¾*d*.

Weights of Eggs from the Different Breeds.—The eggs were valued at the average price per dozen at the London, Bristol and Wolverhampton Markets during the corresponding period of the previous year 1913–14. The eggs were divided into four grades and valued as follows :—

1st. Those which scaled 2 oz. and over—Full market price.
2nd. ,, ,, over $1\frac{3}{4}$ oz.—10 per cent. less than 1st grade.
3rd. ,, ,, over $1\frac{1}{2}$ oz.—25 per cent. ,, ,,
4th. Eggs weighing less than $1\frac{1}{2}$ oz.—Not valued.

The following table shows the variation in size of eggs for each section :—

Section.	Breed.	1st Grade.	2nd Grade.	3rd Grade.	4th Grade.
		Per cent.	Per cent.	Per cent.	Per cent.
1	Leghorns	84·25	14·65	1·05	0·05
2	White Wyandottes	83·30	14·80	1·85	0·05
3	Rocks, Orpingtons and Rhode Island Reds	90·51	9·32	0·16	0·01
4	Sussex and Faverolles ..	91·71	8·16	0·13	—
	Average	87·44	11·74	0·79	0·03

It will be noticed (1) that Leghorns and White Wyandottes show a great similarity as regards the percentage of eggs of the various weights produced ; and (2) that the other breeds included in the test produced heavier eggs than those of Leghorns and White Wyandottes.

Analysis of Laying.—Taking the competition as a whole, 1·66 per cent. of the birds laid 240 or more eggs, 6·67 from 220 to 239, 10·67 from 200 to 219, 23·67 from 180 to 199, 22·33 from 160 to 179, 13·67 from 140 to 159, and 21·33 per cent. laid less than 140 eggs in the ten months.

Eggs were at their highest value between the end of October and Christmas, so that an examination of the percentages laid between these dates is interesting. For all the birds this percentage was 12·1 ; for White Wyandottes 13·4 ; for Rocks, Orpingtons and Rhode Island Reds 13·1 ; for Sussex and Faverolles 12·0 ; and for Leghorns 10·8.

As regards relationship of egg production in the first three months to the total laid during the whole ten months it was found that the more eggs the birds laid in the ten months the more did they lay in the first three months.

From an examination of the dates of hatching, it appears that the highest layers are those hatched in March and April in the case of Leghorns, and in March in the Wyandottes and other breeds in the test.

Foods and Cost of Feeding.—Particulars of foods fed and the cost of food in the production of eggs in 1914–15 are given in the following table, and the data are compared with those of previous years :—

——	1914–15.	1913–14.	1912–13.
Average food per bird per day ..	4·5 oz.	3·9 oz.	4·25 oz.
Average cost of food per lb.	1·23*d.*	·94*d.*	1·0*d.*
Average cost of food per bird per week	2·45*d.*	1·56*d.*	1·8*d.*
Average quantity of food to produce 1 lb. eggs	4·8 lb.	3·82 lb.	5·4 lb.
Average scale value of 1 lb. eggs (8) ..	10*d.*	9·76*d.*	9·6*d.*
Average gross profit on every lb. eggs produced	4*d.*	6·17*d.*	4·8*d.*

The 4·5 of food per bird per day comprised 3·3 oz. of grain and 1·2 oz. of soft food, including vegetables, which were steamed and included

in the mash. The grain foods fed during the year were wheat, oats, cracked maize, barley, dari, linseed, buckwheat, millet and hempseed; the meals were sharps, bran, biscuit meal, fish meal, bone meal and meat meal; the vegetables were clover heads, cabbage and mangolds; and, in addition, flint grit, oyster shell and ground charcoal were used.

The cost of food per head for the ten months was 8*s.* 10¾*d.*, equivalent to 2½*d.* per week of seven days; 1 lb. of eggs valued at 10*d.* was produced by 4·8 lb. of food valued at 6*d.*, so that the profit per lb. of eggs over the cost of food was 4*d.* (*i.e.*, 66 per cent.).

Three feeds a day were given to the birds. The morning feed consisted chiefly of various grains, thrown in the litter, the grains consisting of 2 parts oats, 1 part crushed maize, and a mixture consisting of 8 parts dari, 8 parts cracked peas, 6 parts buckwheat, 4 parts millet and 1 part hempseed; the feed was varied by substituting dari or barley for maize. The midday feed was a mash consisting of 4 parts sharps, 1 part bran, 1 part biscuit meal, 1 part fish meal, and 1 or 2 lb. of clover; the three last were scalded together and dried off with sharps and bran; clover was used twice or thrice a week, while at other times cabbage or mangolds were steamed; occasionally a little of the mixture would be steamed with vegetables in place of biscuit meal or fish meal; a little charcoal would be added twice or thrice a week before mixing the mash. The afternoon feed consisted chiefly of wheat varied with dari, barley, or oats, scattered in the litter. At times the birds were only fed twice a day, when the mash was given as the first feed and corn as the afternoon feed.

OFFICIAL NOTICES AND CIRCULARS.

THE Ministry of Food have made the following Orders under Regulation 2F of the Defence of the Realm (Consolidation) Regulations, 1914:—

Food Control Orders.

Oats (Export from Ireland) Order, 1917.—Except under the authority of the Department of Agriculture and Technical Instruction for Ireland, no person shall export or ship any oats from Ireland to any destination outside Ireland.

This Order is in force from 15th January to 31st March, 1917.

Feeding of Game Order, 1917.—Except under the authority of the Food Controller no person shall feed any game birds with any wheat, pulse, or other grain or foodstuffs. The expression "game birds" shall include pheasants, partridges, quail and wild duck. The Order came into force on 15th January.

Milk (Use in Chocolate) Order, 1917.—Except under the authority of the Food Controller, no person shall use in the process of the manufacture of chocolate any milk produced after 15th January and before 1st April, 1917, or any milk powder or condensed milk manufactured between the same dates.

Wheat (Restriction) Order, 1917.—Except under the authority of the Food Controller, no person shall use any wheat except for the purpose of seed, or except in the process of manufacturing flour. This Order shall not apply to tailings, screenings or damaged wheat unsaleable for milling.

Manufacture of Flour and Bread Order, 1917.—This Order makes an important extension of the two existing Flour and Bread Orders,* under which millers are now required to extract from wheat a flour averaging 76 per cent. of the grain. Under the new Order every miller

* See the present *Journal*, p. 1022, and that for December, 1916, p. 903.

will be required, as from 29th January, 1917, to add to the prescribed percentage a further percentage of not less than 5, either by a further milling of wheat or by the addition, at his option, of flour derived from barley, maize, rice, or oats. He may, if he chooses, add a further 5 per cent. (making 10 per cent. in all) in addition to the compulsory 5 per cent. The existing requirements of the Bread Acts of 1822 and 1836 for the marking of loaves with an M to indicate that they are mixed are abrogated during the continuance of the Order. Though the new provisions as to milling and mixing come into operation on 29th January, a further period up to 12th March is allowed within which stocks of flour not in accordance with the new provisions may be sold. The new Order replaces the existing Orders, and repeats the substance of them with some minor variations.

Fixed Prices for Potatoes of the 1916 Crop.—A further Order will be made almost immediately fixing the prices to be paid, whether by the Army or by civilians, to all growers in the United Kingdom, for potatoes of the 1916 crop. The prices will be £8 per ton for first quality potatoes in January and February, £8 10*s*. in March and April, and £9 in May and June. The same Order will fix the prices of seed potatoes by a schedule taking account of the relative values for this purpose of different kinds. The maximum price for the best kinds will be £12.

Armlets and Certificates for Women Workers on the Land.

THE President of the Board of Agriculture and Fisheries has decided that, in future, the armlet of green baize bearing a red crown may, in the discretion of the County Women's War Agricultural Committees, be issued to any woman or girl over school-leaving age who has actually worked on the land for not less than 30 days or 240 hours.

The distribution of the armlets will be entrusted as heretofore to the District Representatives of the County Women's War Agricultural Committees who will, as a rule, issue the armlets through the Village Registrars.

Applications for armlets should be made by women workers to the nearest Village Registrar, who will be expected to satisfy herself before issuing an armlet that the applicant has actually worked on the land for not less than 240 hours since the commencement of the War.

Any woman who has qualified for an armlet will be entitled to receive a certificate, signed by the Presidents of the Board of Trade and the Board of Agriculture and Fisheries, bearing the Royal Arms emblazoned in colours.

District representatives may apply to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., for the number of armlets and certificates required, which will be sent either to them direct or, on their order, to any village registrars whose names and addresses are supplied to the Board.

The Value of Tithe Rentcharge for 1917.

THE sum payable yearly in respect of Tithe Rentcharge is its value as varied from year to year in accordance with the average prices of corn during the preceding seven years.

The value of £100 Tithe Rentcharge for 1917 is £92 1*s*. 0½*d*., being £8 18*s*. 5½*d*. more than the value for last year. This is the greatest change in the value of Tithe Rentcharge in any one year since the passing of the Tithe Commutation Act, 1836.

In the past 80 years, the value of Tithe Rentcharge has been above par for 31 years and below par for 49 years, the highest value of £100 Tithe Rentcharge being £112 15*s.* 6¾*d.* in 1875, and the lowest value £66 10*s.* 9¼*d.* in 1901. The average value of £100 Tithe Rentcharge for the 80 years 1837–1916 has been £91 11*s.* 1¾*d.*, or 9*s.* 10¼*d.* less than the value for the current year.

Fixed Prices for Wheat, Oats and Potatoes grown in 1917.

THE Food Controller, after consultation with the Agricultural Departments of Great Britain and Ireland, has fixed the following prices to the growers for wheat, oats, and potatoes of the 1917 crop:—

WHEAT .. 60*s.* per qr. of 504 lb.
OATS .. 38*s.* 6*d.* per qr. of 336 lb.
POTATOES (main crops) in quantities of not less than 6 tons f.o.r. or f.o.b.*
115*s.* per ton for delivery from 15th September to 31st January.
120*s.* per ton for delivery in February and March.
130*s.* per ton for the remainder of the season.

The prices in each case are for produce of first quality delivered, as required, in sound marketable condition.

Further announcements will be made respecting seed corn and seed potatoes for use in 1918, and early potatoes of the 1917 crop.

Manufacture of Agricultural Machinery.

THE Ministry of Munitions announces that an Agricultural Machinery Branch has been set up in conjunction with the Board of Agriculture and the Food Controller to deal with the control of the manufacture of agricultural machinery and implements. It is intended to class the manufacture of all such machinery and implements as munitions work.

Mr. S. F. Edge has lent his services to the Ministry of Munitions as Director of this Branch, and Mr. E. Guy Ridpath is Deputy Director.

An Advisory Committee of representatives of the agricultural machinery trade to advise the Branch generally has been established, on which the following gentlemen have consented to serve:—

A. Bornemann (Ruston, Proctor and Co., Ltd., Lincoln).
R. H. Fowler (J. Fowler and Co., Leeds).
W. Harrison (Harrison, Macgregor and Co., Leigh).
J. Howard (J. and F. Howard, Bedford).
E. C. Ransome (Ransomes, Sims, and Jefferies, Ipswich).
J. Segar (R. Hornsby and Sons, Ltd., Grantham),

with representatives of the Ministry of Munitions, the Board of Agriculture, and the Food Controller.

Army Requisition of Home-Grown Wool.

THE Army Council have issued two Orders, dated 29th December, relating to the sale of wool.

The first Order relates to the sale of home-produced wool grown before 1st January, 1916, and provides that, after 28th January, 1917, no person shall sell such raw wool (including fleece wool and skin wool, but not including daggings, locks, broken and fallen wool) except to authorised persons and at authorised prices. The Order also provides that persons possessing or controlling such wool must furnish such particulars of it as may be required by the Director of Army Contracts.

The second Order relates to raw wool home-grown before and during the season of 1916; after 28th January, 1917, persons having such wool are required to sell it as may be required by the Director of Army Contracts on authorised terms and conditions.

THE following Memorandum was addressed by the President, on 28th December, 1916, to War Agricultural Committees in England and Wales:—We have two objects before us. One is immediate—the spring sowing in 1917. The other is more remote—the preparation of an arable area for the next cereal year.

Food Production.

Farmers want—and the nation expects them—to grow all the essential food they possibly can both for human consumption and for the maintenance of live stock.

The following table shows the area of arable cultivation in England and Wales on 4th June, 1914, and the use to which the land was put:—

	acres.		acres.
Wheat	1,807,498	Rape	70,461
Barley or Bere ..	1,504,771	Vetches or Tares ..	123,730
Oats	1,929,626	Lucerne	53,654
Rye	53,899	Hops	36,661
Beans	294,016	Small Fruit ..	77,358
Peas	168,841	Clover, Sainfoin, and Grasses under rotation	2,381,351
Potatoes	461,621	Other Crops ..	148,625
Turnips and Swedes	1,045,094	Bare Fallow ..	340,737
Mangold	432,367		
Cabbage	52,184		
Kohl-Rabi	15,760		

Our immediate task is at least to maintain and, if possible, to increase the acreage, and everywhere to better the totals of production.

Speaking very broadly, we grow at home in ordinary years—

One-fifth of the wheat we consume.
Three-fifths ,, barley ,,
Four-fifths ,, oats ,,
Two-thirds ,, beans ,,
One-half ,, peas ,,

All the rest we buy abroad. The more we can grow at home, the less our demand on shipping, the less money we put into the pockets of foreign producers, and the more we put into our own.

Wheat is an urgent necessity. Unfavourable weather has prevented farmers from getting in the usual quantity. But spring wheat is something of a speculation. Much will depend on the month of February. Wherever there is a reasonable prospect of success, wheat should have the priority and should be sown. The risk of failure to secure a good yield of spring-sown wheat is recognised in the contract price for the harvest of 1917, namely, 60*s.* per qr. of marketable wheat weighing 18 stone to the sack. But full crops of oats or barley are better than half crops of spring-sown wheat.

Oats are of the utmost importance. The demands of the War Office are enormous on behalf of the Allies as well as ourselves. Subject to what has been said as to wheat we cannot have too large an area devoted to oats.

Barley for grinding is again of the greatest value. We all know that some land is better adapted to the growth of barley than to that of either wheat or oats. Such land, if the risk of spring wheat appears too great, is put to its best productive use by being tilled for the crop to which it is best adapted.

Potatoes again are invaluable. We cannot take risks with essential food supplies, and farmers will be protected against the consequences of a glut by a contract price.

For live stock we cannot have too large a supply of peas and beans. Both are most important.

Nothing need be said as to grass—meadow as well as seeds—and roots. Farmers are well aware of the national importance of feeding their flocks and herds, and therefore, on this point, need no reminder.

Farmers will, I am confident, bear in mind the needs of the nation in planning their cropping of the land which they occupy. Those needs are pressing and paramount. Certain crops bring them profits as individuals; but their production to-day is a national loss. Such field crops as mustard grown for seed, beyond the actual requirements of the condiment, are, from this point of view, unprofitable. By the same test cabbages are more profitable than Brussels sprouts with their smaller yield per acre and great expenditure of labour in gathering. The same remark applies to luxuries on which the nation at this crisis ought not to spend its money, such as parsley, or flowers. The object which the War Agricultural Committees will steadily bear in mind is the greatest possible production of essential foodstuffs for man and beast.

The figures of the crops produced by your county in 1874 and 1894 are attached. I cannot believe that any number of farmers desire to chaffer about profits. Provided that they are secured a fair return on their skill and capital they do not, at this national crisis, require to be stimulated by pecuniary inducements to raise the largest quantity of food that the crippled state of their industry will allow. Every help that can be given will be rendered. Questions of labour, machinery, fertilisers, and feeding stuffs are all being considered with the utmost attention.

Do not let us be discouraged by the many circumstances against us. For the nation's sake let us take as our motto for 1917 and 1918 "Back to the Seventies and better." We cannot do more. I am sure that farmers will not do less.

If possible, a further letter* will be in your hands by Saturday on (1) the organisation of County Agricultural Committees; (2) the breaking up of grassland; (3) the organisation of village groups for potato-growing and pig-keeping, and other points.

R. E. PROTHERO.

THE following is a copy of a Memorandum of 29th December, 1916, from the President to the County War Agricultural Committees in England and Wales.

I ask the attention of War Ag icultural Committees to the following points:—

(1) Organisation of War Agricultural Committees.
(2) The survey of the land, etc.
(3) The ploughing up of grass.
(4) The organisation of potato-growing and pig-keeping groups in the villages.

(1) *The Organisation of War Agr cultural Committees.*—I propose to call for as few returns as possible But I should like to receive revised lists, as soon as the organisatio is complete, of the members of the

* Printed below.

Committee for the county, and of the sub-committees for the districts into which the area is divided.

It is suggested that the Committee would probably find it convenient where they have not already done so, at some stage or other in their proceedings, to form a small Central Executive Committee consisting of men of practical agricultural experience who could give constant attention to the work. Farmers will in most instances want to be themselves on their land. It is too much to expect that they can give continuous attendance. But in the intervals between the meetings of the Committee the Executive Committee could keep the work going.

(2) *The Survey of the Land, etc.*—As regards the land survey, the Essex scheme for surveying the land of the county was sent in fulfilment of a request and a promise. But it may be thought unnecessary to obtain a return of the land which is well farmed. The immediate objects are to ascertain whether it is possible to maintain the existing arable area in cultivation, and, if so, to ascertain the quantity and situation of other land which, without expensive and protracted operations such as any large scheme of drainage, can be put to a more profitable use for the spring production of essential food. The further object is to mark down the land which can be brought into arable cultivation for the harvest of 1918. In each of the districts, into which it is hoped that the Committee will subdivide its area, local landowners, farmers, land agents, surveyors, and tenant-right valuers will be able, from their existing knowledge, to give most of the information that is required.

The shortage of labour has in some places necessitated neglect to clean ditches and scour water-courses. Where this has resulted in flooding, and the land could be immediately cleared by concentrating a number of men upon the work, the locality should be noted.

The Board has obtained the services of all German prisoners and interned aliens who are experienced in agriculture. It also hopes to secure a supply of motor tractors. In order to distribute this labour to the best advantage, it is suggested that the War Agricultural Committees should send to the Board a statement of the acreage of land which, in their opinion, ought to be dealt with at once, in their areas, and of the blocks, if any, which lie together compactly. The Committee should at the same time ascertain what housing facilities exist within their areas for groups of men (*e.g.*, workhouses or buildings which could be rapidly adapted), and estimate the numbers of men who could be thus accommodated.

The Surveyors' Institution, the Land Agents' Society, and the Auctioneers' Institution, and it is hoped the Central Association of Agricultural and Tenant Right Valuers, have kindly promised their help. I believe that many of these gentlemen and other qualified persons will place their services at the disposal of the Committee without payment of more than their out-of-pocket expenses. The Committees are authorised to pay these expenses as well as to buy the necessary maps out of the grants made by the Board.

(3) *The Ploughing up of Grass Land.*—This is a matter which, I am sure, will receive the careful attention of the Committee. Apart from improvement in existing methods, use of fertilisers and seeds, etc., there can be no increase in gross production without adding to the arable area. The ploughing of temporary grasses for corn only increases the area by substituting one arable crop for another. An actual addition to the land under the plough is therefore urgently needed, and Commit-

tees will fail in their duty if they do not satisfy the need. I am sure that landowners will, as a body, recognise the paramount claim of the necessities of the nation. In the hands of practical agriculturists, I do not think that compulsory powers for ploughing grass will be abused. Steps are being taken to arm the Board with these powers. But it seems to me necessary that their use should be carefully regulated. The following rule must be adopted.

If, in the opinion of the Committee, any area of grass ought to be ploughed, the unconditional consent of the landowner should, in the first instance, be asked. If the landowner consents, the work will proceed. If he refuses his consent, the area in question should be inspected and reported on by a committee consisting of a practical farmer and a qualified local land agent, surveyor or valuer. Notice should be given of the inspection to the landowner so that he may be present or be represented by his agent. The Board will be guided by the report in issuing any Order.

(4) *Potato-growing and Pig-keeping in Villages.*—For the organisation of potato-growing and pig-keeping in the villages it is suggested that the War Agricultural Committees might delegate this special side of their work to some individual or organisation within their areas. For example, the Director of Education for the county might organise it through the masters or mistresses of the elementary schools in each parish; or the whole organisation might be entrusted in other counties to Mr. J. L. Green, the Secretary of the Rural League, 21, Surrey Street, Strand, W.C., who has placed his services at the disposal of the Board and commands a large staff of agents in many parts of England south of the Humber. Whatever plan may be adopted, the Women's War Agricultural Committees, who have Registrars in many rural villages, could give invaluable help. By whatever means the work is organised it would be under the supervision of the War Agricultural Committee.

If this delegation of the potato-growing and pig-keeping branch of the work were adopted, the work could be organised, the intending growers collected locally into groups, and the quantities of seed potatoes required could be ascertained, without waiting for the completion of the survey on which the Agricultural Committees are now engaged. For this grouping of small societies, with mutual responsibility, the Agricultural Organisation Society, Queen Anne's Chambers, Tothill Street, Westminster, S.W., who have placed their services at the disposal of the Board, may be of great assistance to the Committee. The Board cannot yet definitely undertake to supply the seed; but I do not recommend that War Agricultural Committees should for the present attempt to buy it for themselves. The quantities required is at the moment the main point, and, as soon as this is ascertained, the figures should be forwarded to the Board.

I desire to add that powers are being taken to enable the Board either themselves or through their duly authorised agents, to take action wherever they find a farm or part of a farm derelict or inadequately cultivated, either by taking possession and realising the crops or by doing the necessary acts of spring cultivation and recovering the cost from the occupier. As soon as I receive information as to the organisation of the various War Agricultural Committees [see (1) above] I will notify you of the decision as to the local bodies to which the Board will delegate powers.

R. E. PROTHERO.

Survey of Land for the Purposes of Food Production.

THE following Circular Letter (with enclosure), dated 23rd December, 1916, was addressed by the President of the Board of Agriculture and Fisheries to the Secretaries of War Agricultural Committees :—

Sir : At the meeting of the Federation of the War Agricultural Committees on the 20th inst., a wish was expressed by various members to see the outline of the scheme adopted by the Essex War Agricultural Committee for making a survey of the land in the county. I therefore send a copy of the scheme.

The scheme carries out the idea which I had in my mind when asking the War Agricultural Committees to ascertain what land was inadequately cultivated or derelict in their respective counties. But it does not follow that the Essex scheme is the best for all counties and it is only sent to assist your Committee.

The Board of Inland Revenue have placed the services of the Land Valuation Department at my disposal for assistance in the work of such a survey, and have instructed the District Valuers in England and Wales accordingly.

The specific assistance which the Valuation Department is prepared to give is as follows :—

(1) Inspection in the District Valuer's Office of the record plans of agricultural areas.

(2) Information from official records, so far as this has not been obtained confidentially.

(3) Such clerical assistance as the District Valuer finds himself able to accord from his existing staff after dealing with his own immediately necessary work. Such assistance to be given in the District Valuer's Office.

It is very desirable that at the earliest possible date the War Agricultural Committees should enquire what real deficiencies exist in the supply of agricultural implements necessary for the spring sowing. The Ministry of Munitions will do their utmost to supply what is absolutely needed. But their resources are strictly limited. For the moment the enquiry should be directed towards ploughs, drills and harrows.

I hope to send out a letter in the course of the next few days, giving suggestions in detail with regard to the future work of your Committee.

I am, etc.,

ROWLAND E. PROTHERO.

ENCLOSURE.

Essex War Agricultural Committee Scheme for an Agricultural Survey of the County.—The War Agricultural Committee have invited the Essex Agricultural Valuers' Association to assist them in making an agricultural survey on the following lines :—

Each valuer will be supplied with 6-inch Ordnance Survey maps of the district, with which he will deal, and they will indicate thereon by different colouring the different classes of land and farming.

Three main classes for land will be adopted and the classes will be sub-divided as follows :—

I. Land well farmed—
   (*a*) acreage of arable ;
   (*b*) acreage of grass land.

II. Farmed land not producing up to its capabilities—
(*a*) acreage of arable ;
(*b*) acreage of grass land which, given the necessary factors of production, could be brought into arable cultivation;
(*c*) acreage of grass land which must be improved as such.

III. Derelict land—
(*a*) acreage of coarse, weedy grass land which, given the necessary factors of production, could be brought into arable cultivation ;
(*b*) acreage of grass land which must be improved as such ;
(*c*) acreage of other waste land, *e.g.*, undeveloped building land.

[NOTE.—The Board understand that the Committee do not propose to deal with land which requires draining or grass land which cannot be broken up without serious permanent depreciation of its value.]

THE following Memorandum was sent to War Agricultural Committees on 2nd January :—

Survey of Agricultural Land : Maps.

Committees who desire to obtain 6 in. Ordnance Survey maps for the purpose of making a survey of agricultural land on the lines of the Essex scheme referred to in Mr. Prothero's letter of the 23rd ult. should order the maps direct from the Director-General, Ordnance Survey, Southampton. If this course is adopted no payment need be made by the Committee, as the Board will settle the account with the Director-General direct.

Restrictions on Dealings in Seed Potatoes in Great Britain.

AT the request of the Food Controller, and in consultation with the Board of Agriculture, the Board of Trade have made an Order (of which the operative provisions are set out below) designed to safeguard the supply of seed potatoes for next year's crop. This Order does not affect existing contracts for potatoes intended solely for seed purposes ; the fulfilment, however, of contracts for the sale of potatoes for other purposes may be interfered with by the terms of the Order.

The operative provisions of the Order are as follows :—

1. Seed potatoes shall be used for the purposes of seed only, and accordingly no person shall use any seed potatoes for any other purpose than seed. Provided that nothing in this Regulation shall affect the use of potatoes in his own household by a grower not being a grower for sale.

2. No person shall sell any seed potatoes to any person other than an authorised purchaser, and no person other than an authorised purchaser shall buy any seed potatoes.

For the purpose of this provision an authorised purchaser means a person dealing in seed potatoes in the way of his trade or business, or a person who shall on the occasion of the sale of seed potatoes to him certify in writing to the vendor thereof that the potatoes comprised in such sale are required and intended to be used for the purposes of seed.

3. This Order shall not affect seed potatoes which are diseased or blemished, or which under any Order made under the Destructive Insects and Pests Acts, 1877 and 1907, may not be used for seed.

4. Any person acting in contravention of the above recited provisions as applied by this Order is guilty of a summary offence against the Defence of the Realm Regulations.

5. For the purposes of this Order the expression "seed potatoes" means potatoes of a variety or description specified in the first column of the schedule appended to this Order which will pass through a riddle having such mesh as is specified in the second column of such schedule in relation to such variety or description, and will not pass through a riddle having such mesh—as is so specified in the third column of such schedule.

6. (*a*) This Order may be cited as the "Seed Potatoes Order, 1916."
(*b*) This Order shall extend to England, Wales, and the mainland of Scotland, and to the islands of Bute and Arran.
(*c*) This Order shall come into force on the 18th day of December, 1916.
(*d*) This Order shall remain in force until the 15th day of March, 1917.

SCHEDULE.

Variety.	Mesh of Riddle. ins.	ins.
Part I.—Potatoes grown in the Mainland of Scotland and the Islands of Arran and Bute—		
Arran Chief	2¼	1
King Edward	2	1
President	2	1¼
Evergood	2	1¼
British Queen	2	1¼
Great Scot	2¼	1
King George V.	2¼	1
All other varieties so grown	1⅝	1¼
Part II.—Potatoes grown in England and Wales from Scotch seed of the 1915 crop—		
Arran Chief	2	1
King Edward	1¾	1¼
British Queen	1¾	1¼
Great Scot	2	1
King George V.	1¾	1¼
Evergood	1¾	1¼
Royal Kidney	1¾	1
All other varieties so grown	1⅝	1¼
Part III.—Potatoes grown in England and Wales from seed other than Scotch seed of the 1915 crop—		
All varieties so grown	1⅝	1¼

* * * * *

THE following Circular Letter was addressed by the Board on 23rd December, 1916, to War Agricultural Committees:—

Distribution of Seed Potatoes.

SIR: I am directed by the President of the Board of Agriculture and Fisheries to advert to the Board's Circular letter of the 19th inst.,* having reference to the preparation of schemes for the distribution of seed potatoes to small growers, and I am to say that in consequence of developments which have taken place since the issue of that letter Mr. Prothero thinks it desirable that War Agricultural Committees should confine themselves for the present to collecting information as quickly as possible from Parish, Urban District and Borough Councils as to the probable extent of the demand for seed potatoes from the small growers in their districts, and that the Board

should be promptly informed of the total quantity likely to be so required in your county. On receipt of such information the Board will be in a better position to take such steps as may be necessary to secure the quantities required, and in the meantime Mr. Prothero thinks that it would be inadvisable for Committees to go into the market and make purchases for themselves. It is important to avoid the danger of competitive buying by a number of different authorities.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

THE following Circular Letter, dated 19th December, 1916, addressed to the Secretaries of War Agricultural Committees, is that referred to in the above letter :—

Distribution of Seed Potatoes.

Sir : I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's Circular Letter of 18th February last (A. 261.C.) regarding the distribution of Scotch seed potatoes to allotment holders and small cultivators, and to express the hope that arrangements for this purpose, organised with so much success in several counties last year, will be repeated during the coming season and adopted by as many other counties as possible.

A short account of the scheme successfully carried out in Somersetshire appeared in the Board's *Journal* for last July,* and the President thinks that it may be useful briefly to recapitulate here the steps taken in that county and to record the success and incidentally, the difficulties which attended their efforts.

Parish Councils, Parish Meetings, Borough and Urban District Councils were requested, by the Secretary of the Agricultural Instruction Committee of the County Council, to appoint a person in each village to ascertain what quantities of seed potatoes were required, to arrange for their distribution and to collect cash with orders. The orders, with the cash, were sent in to the Secretary who arranged with a firm of Scotch potato merchants for the delivery of the potatoes to convenient distributing centres in cwt. bags. Not more than 5 cwt. were supplied to any one grower. The varieties offered were Arran Chief, Up-to-Date and Dalhousie. Altogether orders for 200 tons were received through 216 different individuals, representing, probably, between 3,000 and 4,000 individual buyers. It was found that the potatoes would have to be sent to 73 different stations, but these were arranged in groups so that the bulk of a load was sent to one centrally situated station and the remainder redistributed to other stations in the same area. In this way the number of areas was reduced to 28.

The total receipts for potatoes were £1,275. The amount paid for potatoes was £853, and for carriage £327 ; the expenses of the scheme were £16. There was thus a profit of £79 after covering all expenditure, and this amount is being held for future use. This profit was due to the unexpectedly large quantity of potatoes ordered and to the consequent cheaper cost of carriage and of distribution.

The Board have received most favourable accounts as to the growth and vigour of the potatoes from all the counties where a seed distributing scheme was in operation ; and the President is satisfied that work of this kind is likely to be of advantage to all concerned and of importance to the maintenance of the national food supply.

It is clear that the success of a scheme of this kind must depend largely on (1) the efficiency of the central and local organisation, (2) the system of cash with order, (3) the reliability and integrity of the seed merchant, (4) the limiting of the orders to as few varieties as possible, and (5) the placing of the orders early. A further consideration is the scarcity of sacks. Where vendors cannot guarantee to supply sound sacks, I am to suggest that the purchasing authority should endeavour to forward sacks to the merchant.

The President further desires me to point out that in view of the deficient crop in Scotland much smaller quantities of Scotch seed will be available for planting in England than usual next spring. In these circumstances he thinks that the deficiency might be made good by using "once-grown" Scotch seed. Except, perhaps, in the South Eastern counties where the July drought was severely felt, once-grown seed should prove almost or quite as satisfactory as new seed.

The Board, in concert with the Board of Trade, are endeavouring to arrange measures to ensure that a sufficient supply of seed for the requirements of the country shall be available.

In some districts the Regulations of the Board for controlling the disease known as Wart Disease of Potatoes are in force and the planting of any potatoes other than those authorised by licence of the Board is prohibited. The President desires me to call your special attention to these Regulations and to request that you will exercise great care in arranging for the distribution of any seed potatoes among occupiers of Wart Disease infected premises or of a Wart Disease infected area.

In view of the special urgency and importance of increasing the area under potatoes in 1917 and of the difficulty of securing good seed, the President would be obliged if your Committee would give this subject their earnest consideration at the earliest possible date, holding, if necessary, a special meeting for the purpose, and will inform him of the steps they may be taking or may propose to take to provide and supply seed potatoes to small holders and the occupiers of allotments and private gardens.

I am to add that in view of a probable shortage in the supply of seed potatoes for planting next spring it may be desirable that arrangements should be made at once for the purchase by your Committee of sufficient seed potatoes to meet the probable needs of the small growers in your county without waiting to collect cash with their orders before the purchase is effected. In these circumstances the Board are prepared to authorise your Committee to incur expenditure on this account on behalf of the Board and the Board will be prepared to meet any loss which may occur on the transaction. I am to say, however, that the Board rely on your Committee to take all possible precautions to see that the receipts from the sale of the seed potatoes are sufficient to recoup the expenditure of the Committee in the matter.

With a view to procuring publicity for the subject of this matter, Mr. Prothero would suggest that you might communicate a copy of the letter to the local Press, or furnish them with a statement for publication as enclosed.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

ENCLOSURE.

Arrangements have been made by the Board of Agriculture and Fisheries with the Treasury to finance a scheme for the distribution of

seed potatoes. The President has invited the County War Agricultural Committees to request Borough and Urban Councils and Parish Councils to ascertain what quantity of seed potatoes is required in each village; to collect cash with orders and to distribute seed. It is proposed that arrangements should be made to deliver the potatoes at convenient distributing centres in 1-cwt. bags. Not more than 5 cwt. may be supplied to each grower, and the range of varieties will necessarily be limited.

Varieties of Potatoes Resistant to Wart Disease.

THE following list of varieties of potatoes recommended by the Board of Agriculture and Fisheries for planting on Wart Disease infected premises and infected areas in England and Wales in 1917 has been compiled as a result of the Board's trials at Ormskirk. All persons who wish to be put on the Board's list of approved dealers should make application at an early date :—

Early Varieties.—(1) A1. (Sutton), (2) Resistant Snowdrop (Dobbie), (3) Edzell Blue.

Second Early Varieties.—(4) Conquest (Findlay), (5) King George (Butler), (6) Great Scot (McAlister), (7) Southampton Wonder (Toogood), (8) Sir Douglas Haig (Sands), (9) The Duchess (Dobbie), (10) The Ally.

Late or Maincrop Varieties.—(11) Abundance (Sutton), (12) Culdees Castle (G. R. Sharp), (13) King Albert (Sands), (14) The Provost (Dobbie), (15) Crofter (Dobbie), (16) Jeannie Deans (Findlay), (17) Favourite (Sutton), (18) Twentieth Century (Dobbie), (19) The Admiral (Dobbie), (20) Burnhouse Beauty (Dobbie), (21) The Laird (Davie), (22) Langworthy (Niven), (23) What's Wanted (Niven), (24) Golden Wonder (Brown), (25) Rob Roy (McAlister), (26) The Lochar (Farish), (27) Heather Bountiful, (28) Leinster Wonder (Sands), (29) The Templar (Wilson), (30) Kerr's Pink (Kerr), (31) The Rector (Wilson), (32) Irish-Queen (Sands), (33) Shamrock (Sands), (34) White City (Sutton), (35) St. Malo Kidney, (36) Dominion (Poad).

A list of the above varieties, giving a short description of the characteristics of each variety, can be obtained free of charge on application. (Please quote $A\frac{219}{1}$.)

The Board recommend all occupiers of land infected with Wart Disease to plant one or more of these varieties, but they take this opportunity of reminding all such persons that it is illegal to plant *any* potatoes on land which has been declared by a notice served by a duly authorised inspector to be infected premises or on land which has been declared to be part of an infected area by an Order of the Board, except potatoes authorised to be so planted by a licence granted by an inspector. The penalty for illegal planting is a fine of £10.

All persons who wish to obtain a licence to plant should make application on a form, which will be sent on demand, addressed to the Horticulture Branch, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. Letters so addressed need not be stamped.

The following varieties are highly susceptible to Wart Disease of potatoes and cannot be planted on infected premises :—

Early Puritan, Epicure, Midlothian Early, British Queen, Duke of York, Sharpe's Express, Sharpe's Victor, Sir John Llewellyn, Evergood, Cora, Cigarette, King Edward VII., Up to Date, Dalhousie, Duchess of Cornwall, Arran Chief, Factor, Prolific.

THE following Memorandum was despatched on 22nd December, 1916, to the Secretaries of War Agricultural Committees and to the Board's Representatives before the Local and Appeal Tribunals :—

Agriculture and Recruiting.

The enclosed extract from a notice issued by the Army Council as a result of representations by the Board is sent to you for your information.

The effect of the notice is that the arrangement set out in the Board's Circular Letter of the 5th October last under which no man employed in agriculture was to be called up until 1st January, 1917, has been extended until a complete review of the situation as regards agricultural labour can be made in the light of the information disclosed by the analysis of the Agricultural Census.

Men at present employed in agriculture will, subject to the conditions set out in the notice, be allowed to remain in their civil occupations until further instructions are issued.

Extract from a Notice issued by the War Office on the 21st December, 1916.

The Army Council have decided that, while in some parts of England and Wales there is an unnecessarily strong complement of agricultural labourers, other farming districts have too few men left to secure that increase in food production which is desirable in the national interest.

To enable the just proportion to be settled on a really satisfactory basis a further short period of delay in calling up men from agriculture will have to be recorded. This further period of delay will be effected by granting leave to all agricultural workers who are due to report on the 1st January, 1917, until such time as they receive further instruction to join.

[NOTE.—The above arrangement will not apply in cases where suitable substitutes are supplied by the Military Authorities.]

THE following Notice was issued by the Board on 12th December, 1916 :—

Employment of Civilian Prisoners of War in Agriculture.

The Board think it desirable to bring to the notice of farmers the arrangements made by the Home Office for the employment of *civilian* prisoners of war on farms in districts *which are not "prohibited areas."*

From enquiries which the Board have made in a selected number of cases where farmers have availed themselves of the opportunity provided, it is clear that the men already placed out have given every satisfaction to their employers. The farmers state that the men are invariably willing and useful, and give no trouble whatever.

The men provided under this scheme are not Germans, but are Austrians or Hungarians, or belong to races which are, generally speaking, friendly to the Allies. They are usually able to speak at any rate a little English.

In no case has there been any difficulty between the men employed and the labourers already working on the farms, as it has been quickly recognised that the men are only in a technical sense enemies and are anxious to do anything they can to help the country of their adoption.

The conditions on which the men can be employed are as follows :—

The employer undertakes, in the case of each man, to—

(*a*) tell the police when he arrives ;

(*b*) lodge him on his premises : and remember that he may not change his address, nor travel more than five miles from his (the employer's) house, without getting special permission from the police ;

(*c*) feed him and pay him at the district rate paid to English labourers for the work on the understanding that he is entitled to deduct the cost of the man's board and lodging at the rate of 12*s*. 3*d*. a week ;

(*d*) tell the police *at once* if he should misconduct himself in any way, or should abscond ; or if he should want to dismiss him ;

(*e*) discontinue his employment at the end of the war, or as soon thereafter as British labourers are available.

The man on his side will undertake, as conditions of his release—

(*a*) to do nothing that could harm the British Empire or its Allies in any way (this is the ordinary parole which has to signed by any civilian released from a camp before he is allowed to leave) ;

(*b*) to conduct himself properly in every way and do the work which is given to him.

On receipt of an application a selected man will be despatched as quickly as possible to the applicant's address, free of cost to the applicant. Should he in any way misconduct himself, or should the employer have other reasonable ground for wishing to terminate the employment, he has only to tell the police and they will take the man back to the camp, also free of cost to the employer.

Farmers desirous of employing civilian prisoners should apply to the Secretary of the County War Agricultural Committee for forms of application. The form when completed and signed should be sent to the Secretary, Prisoners of War Branch, Home Office, London, S.W., and postage in this latter case need not be prepaid.

THE following Notice was issued by the Board on 11th December, 1916 :—

Costume for Women Workers on the Land.

In view of the increasing shortage of labour and the consequent difficulty in executing orders for suitable clothing for women workers on the land, the Co-operative Wholesale Society, Limited, have found it necessary to notify the Board of Agriculture and Fisheries that it will not be possible for them in future to continue their present arrangements for the supply of such clothing to the Women's Farm Labour Committees in England and Wales *except for the purpose of clearing off the articles at present in stock*. Orders for the goods still in hand will be executed to the extent of the present stock, which includes only a few drabbet coats, skirts and overalls ; also some oilskin coats and leggings.

The President of the Board of Agriculture and Fisheries desires to take this opportunity of impressing on all County Women's Farm Labour Committees the importance of enabling women to procure dress that is really suitable for work on the land at the most economical rates.

It is particularly necessary that short, strong skirts and strong boots and leggings should be easily obtainable by all women workers, and washable coats by those who are engaged in dairy work. In several cases suitable arrangements for the supply of these articles on advantageous terms have already been made locally by County Women's Farm Labour Committees, and this should be done wherever possible.

THE following Notice, signed by the Presidents of the Local Government Board and of the Board of Agriculture and Fisheries, was issued on 4th January, 1917:—

The Keeping of Pigs, Poultry, Rabbits, etc.

The increase of pigs in this country is the quickest possible way of adding to our meat supplies. If people would, either individually or in combination, undertake the keeping of pigs in the present crisis, the stock of pigs in this country could be, within a few months, greatly increased.

Quantities of valuable pig-food are wasted every day in our towns and villages. If arrangements could be made for collecting the waste from butchers, poulterers, fishmongers, fruiterers, greengrocers and dairies, from the hotels and boarding-houses as well as from other dwelling-houses, this daily loss would not only be prevented but turned into the gain of valuable meat.

It is important, wherever practicable, to allow pig-keeping in the neighbourhood of towns and villages to save the cost of transport of material. The question arises how far this would be hampered by restrictions contained in the by-laws of local authorities.

In many rural districts there are no by-laws on the subject at all. In others the by-laws only require that the places where pigs are kept shall be clean and wholesome. In most urban districts, however, and in a few rural districts, a by-law is in force which provides that pigs shall not be kept within a prescribed distance of dwelling-houses. A Regulation is about to be made giving power to Sanitary Authorities to grant permission for the keeping of pigs, either generally or in particular cases, notwithstanding the provisions of any such by-law, subject to the observance of any directions of the Authority in the interests of public health. If persons intending to keep pigs live in places where such by-laws are in force, they should inform the local authority, with a view to obtaining their permission. It will be necessary for keepers of pigs to obey such conditions as to clean and wholesome maintenance as the local authority may impose.

We intend to bring this matter to the notice of the Sanitary Authorities, and to suggest that, subject to any advice given to them by their Medical Officer of Health on grounds of public health, a Council should not hesitate to consent to waive its by-laws in suitable cases, or, where circumstances permit, to give a general dispensation under the powers conferred by the new Regulation. We shall also suggest that the Councils should do what they can to facilitate co-operative efforts for the collection of waste and for the keeping of pigs.

Householders unable to undertake the keeping of pigs may do admirable service by keeping poultry or tame rabbits in order to add to the nation's food. They may also assist by setting aside edible house refuse to be collected for the feeding of the stock of other people.

Offers of Assistance on Food Production Schemes.

THE following Notice was issued on 14th January, 1917: The President of the Board of Agriculture and Fisheries is receiving a very large number of offers of assistance in connection with his schemes for increased food production. The carrying out of the schemes will be entrusted to War Agricultural Committees in each County, and Mr. Prothero suggests, therefore, that all persons who desire to offer their services should communicate with the Secretary of the local War Agricultural Committee at the offices of the County Council.

Foot-and-Mouth Disease.

THE following Notice was issued by the Board on 27th December, 1916:—

The suspected existence of Foot-and-Mouth Disease amongst animals on premises at Balne, Yorks, W.R., was reported to the Board of Agriculture and Fisheries on Friday last, 23rd December. One of the Board's Veterinary Inspectors visited the premises on the evening of that day and, having found lesions in one of the animals similar to those of Foot-and-Mouth Disease, he advised the Board that that disease existed on the premises.

Precautionary measures were accordingly taken forthwith, which, inasmuch as animals on the farm had recently been bought at York Market from a dealer in Irish cattle, extended to the prohibition of the holding of markets for animals throughout the North of England, and the limitation of the trade in animals from Ireland to those intended for slaughter at the port of landing. Steps were immediately taken to trace the previous history of the animals dealt with in York Market.

Another inspection of the animals at Balne, followed by post-mortem examination on one animal, was made on 24th December. As a result a certain amount of doubt arose as to the correctness of the first diagnosis, and a further test was arranged. The Board's Chief Veterinary Officer visited the premises on 26th December, and after examining the material and inquiring into the facts of the case, he has been able to advise the Board that the disease present there is not Foot-and-Mouth Disease.

Orders are accordingly being issued to-day withdrawing forthwith all restrictions imposed by the recent Orders or Instructions of the Board in connection with this reported outbreak.

As a result of these new Orders animals from Ireland will be free to be landed in this country to-morrow under the normal conditions, and the Department of Agriculture and Technical Instruction for Ireland have been informed accordingly by telegram.

Steps are being taken to inform Foreign Governments of the fact that no outbreak of Foot-and-Mouth Disease has occurred, and that the Board will continue to issue their certificates in connection with the exportation of animals on that basis.

London Thoroughbred Stallion Show, 1917.

A SHOW of thoroughbred stallions suitable for get[illegible] half-bred horses will be held at the Royal Agricultural Hall, Isli[illegible]n, in conjunction with the Hunters' Imp[illegible]ement and National Light Horse Breedin[illegible]ociety, on 27th and 28th February and 1s[illegible]rch, 1917. Sixty King's Premiums (inc[illegible]g twelve Super-Premiums) will be offered by the Board for awar[illegible] the same

conditions as last year. In addition to these the Board are prepared to consider recommendations from their Light Horse Breeding County Committees for the award of, approximately, forty Board's Premiums.

The last day for entry to the show is 22nd January, 1917, and no stallion can be accepted for entry until it has been registered by the Board. Application for registration should be made at an early date.

Copies of the Regulations and Entry Forms for the show can be obtained on application to the offices of the Board, Craven House, Northumberland Avenue, London, W.C., or they will be forwarded by post if desired.

Manufacture of Flour and Bread.

IN connection with the Manufacture of Flour and Bread Order, 1916, the Food Controller has decided that the extract of flour to be obtained from the following descriptions of wheat not dealt with in that Order shall bear in proportion to the total produce of the mills not less than the following percentages :—

New crop No. 1 hard Manitoba	76·0	Scotch	75·0
New crop No. 1 Northern Manitoba	75·0	Irish	76·0
New crop No. 2 Northern Manitoba	73·0	No. 4 Northern Manitoba commercial grade ..	70·0
New crop No. 3 Northern Manitoba	71·0	No. 5 ,, ,,	67·0
No. 2 Chicago spring, 1915, crop	72·0	No. 6 ,, ,,	62·0
New Zealand	76·0	No. 4 Northern Manitoba special commercial grade	65·0
Chilian	74·0	No. 5 ,, ,,	58·0
		No. 6 ,, ,,	48·0

In the case of millers grinding exclusively native wheats (English, Scotch and Irish) an allowance of 1 per cent. will be allowed in the percentage of flour to be obtained, *i.e.*, in milling such wheats they must extract from English or Irish wheat 75 per cent., and from Scotch wheat 74 per cent. (instead of the 76 per cent. and 75 per cent. laid down for these classes respectively in the Order and the foregoing table).

The percentages set out above and the percentages included in the Order must be regarded as strictly provisional and liable to alteration.*

The Flour and Bread (No. 2) Order makes various additions to the descriptions of wheat included in the above Order. (*Board of Trade Journal*, 14th and 21st December, 1916. See also this *Journal*, December, 1916, p. 903.)

Change in Maximum Milk Prices.

The Food Controller has made an Order, the effect of which is given below, varying the Order of 20th November, fixing maximum prices for milk (see *Journal*, December, 1916, p. 902).

The principal changes are as follows :—

1. The proviso limiting the price to be charged for milk so that it cannot exceed the price at 15th November, 1916, is removed. The price of milk will henceforth be limited simply by reference to the pre-war prices, to which, under the original Order, certain definite amounts (5½*d*. or 6½*d*. per imperial gallon in various classes of wholesale sales and 2*d*. per quart in retail sales) may be added.

2. Contracts for the sale of milk made on or before 15th November will be allowed to remain valid for their full period (up to 1st April, 1917), although the price exceeds that otherwise permissible. This extension is subject to an exception only in those cases in which it is

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* See also p. 1005.

shown to the Food Controller that the contract price is unreasonable, having regard to the circumstances of the case.

3. The maximum price for accommodation milk is raised to 1*s*. 8*d*. per imperial gallon, inclusive of all charges for transport to the railway station at which delivery is taken by the purchaser.

4. The addition of 6½*d*. per imperial gallon to the wholesale price in cases of milk sold wholesale to be delivered on the premises of the buyer where the conditions of sale include obligation of delivery in quantities not less than a specified minimum, is limited to cases where the premises are not premises used as creamery or other factory.

Oats Contract: Increased Production of Oats for Army Requirements.

THE Secretary of the War Office notifies that the Army Council have appointed Mr. H. Trustram Eve to assist the Board of Agriculture in increasing the production of oats for Army requirements.

He will undertake, subject to the directions of the President of the Board of Agriculture :—

1. The direct cultivation of War Department lands now under grass.

2. The encouragement of similar cultivation by farmers through the placing of forward contracts for the crop of 1917.

Communications on the subject should be addressed to Mr. Trustram Eve, at 45, Parliament Street, London, S.W.

Census of Wool and Wool Products.

A CENSUS of all wool and wool products in the United Kingdom on 31st December is being taken by the Army Contracts Department under an Order made by the Army Council under the Defence of the Realm (Consolidation) Regulations, 1914. The return is compulsory, and all persons owning 5,000 lb. or more of raw wool, or of wool products such as tops, noils, waste, yarns, etc., or 10,000 yards or more of cloth, dress goods, etc., are required to make a return of their stocks. Persons holding similar quantities on account of clients abroad are under the same obligation. It should be noted that *a return of goods actually in the United Kingdom is required*. Where goods have been sold but not invoiced the return should be made by the holder.

Schedules have been prepared on which the return is to be made, and these are being sent to manufacturers, merchants and others. Any person or firm having stocks as indicated above, who has not received a schedule should apply at once for one to the Director of Army Contracts, R.M.S., 929, Imperial House, London, S.W.

Any person holding stocks of the kind and quality named and failing to make a return incurs the liability of being proceeded against for an offence against the Defence of the Realm Regulations. (*Board of Trade Journal*, 4th January, 1917.)

Maintenance of Supply of Pigs.

THE following Notice was issued on 10th January :—All pig-keepers, notwithstanding the present high price of feeding stuffs, are urged to make every possible effort to maintain the supply of pigs. Sows with access to shelter will pick up a considerable part of the food they require out of doors. Where grass is scarce, a few swedes or mangolds, together with a pound or two of beans

or finely-ground palm kernel cake, will serve to carry most sows through till farrowing time. For fattening pigs, eight pounds of swedes, boiled, are equivalent to one pound of cereal meals or offals. Small or blemished potatoes are twice as valuable as swedes for feeding purposes; but these should be reserved for the later stages of fattening.

To supplement roots, the cheapest and most suitable foods at the present time are finely-ground palm kernel cake, bean meal, maize gluten feed, and dried grains. Later on, clover, sainfoin and lucerne will be available in place of roots, and small holders should consider whether they can find space to add these to their crops.

Edible domestic refuse should be reserved as far as possible for pig-feeding. The pig pail should be kept free from brine, lemons, corks, tins, wire and other injurious substance.

For fuller information and guidance the Board's Leaflet, No. 298, on Pig Keeping (free by post on application) should be consulted.

Leaflets in 1916.

THE following Leaflet has been issued in the ordinary series since the date of the list contained on p. 513 of the *Journal* for August, 1916:—No. 307.—*The Wood Pigeon.*

In addition, the information in the following Leaflets has been revised and brought up to date:—

No. 10.—*Wireworms.*
No. 23.—*Potato Disease.*
No. 35.—*Celery Fly.*
No. 38.—*Carrot Fly.*
No. 26.—*Tenant Farmers and the Income Tax.* This Leaflet has been entirely re-written.
No. 78.—*Tuberculosis of Poultry.*
No. 176.—*Poultry Fattening.*
No. 240.—*Farm Book-keeping.*
No. 241.—*The Construction of Cow Houses.*
No. 253.—*Isle of Wight Bee Disease.*
No. 267.—*Basic Slag.*
No. 270.—*The Sale of Low Quality Manures at Excessive Prices.*
No. 297.—*Seed Testing.* (Formerly Special Leaflet No. 24.)
No. 299.—*Harvesting and Storing of Garden Vegetables.*

Several Special Leaflets have been issued since the date of the last list. The numbers and titles are as follows:—

Special Leaflet No. 60.—*The Preparation of Home-made Rennet.*
,, ,, 64.—*Ground Nut Cake.*
,, ,, 65.—*Continuous Cropping.*

A Welsh translation of Special Leaflet No. 37 (*Economy in Food: Appeal to Country People*) has also been issued.

The following Special Leaflets have been revised and brought up to date:—

Special Leaflet No. 1.—*Suggestions to Allotment Holders for Autumn Treatment of Land.*
,, ,, 16.—*Notes on Pig Feeding.*
,, ,, 32.—*War Food Societies.*
,, ,, 41.—*The Importance of Producing more Cheese.*
,, ,, 46.—*The Use of Sulphate of Ammonia for Wheat.* This Leaflet has been rewritten.
,, ,, 59.—*Successful Employment of Women on the Land.*

PARLIAMENTARY QUESTIONS AND REPLIES ON AGRICULTURAL MATTERS.

Seed Potatoes.—Sir L. Worthington Evans (14th December) asked the Parliamentary Secretary to the Board of Agriculture whether his attention has been called to the disproportionate rise in price of seed potatoes when sold in small quantities of 56 lb. and 28 lb.; and what steps he proposes to take to ensure a supply for small holders and occupiers of allotments at reasonable prices ?

Mr. Acland: The evidence which the Board have does not lead them to the conclusion that there has been in general a disproportionate rise in the price of seed potatoes when sold in small lots. But, undoubtedly, considerable increases in price may take place in such cases, particularly when the potatoes pass through several hands. The Board, therefore, strongly advocate schemes of co-operative purchase by small holders. They have also addressed a letter to the County War Agricultural Committees, giving particulars of a successful scheme for supplying seed potatoes in Somersetshire last season,† and urging all such committees to arrange similar measures immediately with the object of securing supplies of seed for planting in 1917. The Board will do their very best to help the committees to carry out co-operative schemes of this kind. A Departmental Committee has under close consideration the question of preserving a sufficient amount of the present crop for seed next year.

Breeding Stock.—Mr. Wiles (14th December) asked the Parliamentary Secretary to the Board of Agriculture if his attention has been called to the fact that farmers are selling off young cattle from twelve to eighteen months old in unusually large numbers at the present time; and, if so, will he state what measures he proposes to take to prevent the sale and killing of cattle before they are really fit for the butcher ?

Mr. Acland: There is no evidence at present of any serious check to the breeding and feeding of stock. The matter is being closely watched by the Board. There is, however, considerable alarm among farmers at the price of feeding stuffs. This matter has been under investigation by the different Departments concerned, and is being considered. In my opinion, even though there may be present difficulties in maintaining a normal head of breeding stock, it would be a short-sighted policy for farmers to reduce them unduly. The killing of stock at a younger age and in a less highly finished condition than usual is not, necessarily, under present circumstances, uneconomical provided that the total head of breeding stock is maintained.

Feeding of Game.—Mr. King (18th December) asked the Parliamentary Secretary to the Food Control Department whether he is aware of the amounts of maize and other foodstuffs given to pheasants and other birds and to beasts *feræ naturæ*; and whether steps are being taken to stop this waste ?

Captain Bathurst: The hand-rearing of game by means of food fit for human consumption is, under present circumstances, to be deprecated.* The necessary powers to stop game preserving are being obtained and will be exercised.

* See p. 1005. † See pp. 1014–1017.

Mr. Booth: Is my hon. Friend aware of the clauses put in leases by landlords compelling tenants to keep up the stock of game, and how does he propose to deal with that?

Captain Bathurst: If such clauses exist they will be carefully watched by the Department which I am now serving.

Damage by Rats and Mice.—Sir R. Winfrey, replying to Mr. Houston (19th December) said: No exact figures of the losses caused by rats and mice to foodstuffs are available, but the Board are aware that the fecundity of these animals under certain conditions is great, and that rats may disseminate disease. The destruction of rats has been urged upon farmers by the Board, and they have issued instructions for the purpose in a leaflet which has been widely circulated, a copy of which I am sending the hon. Member. It does not appear that the present time, when professional rat-catchers are scarce, is a convenient one for the introduction of compulsory legislation on the subject.

Mustard Cultivation.—Mr. Wiles (14th December) asked the Parliamentary Secretary to the Board of Agriculture if he is aware that 66,000 acres were sown with mustard in this country last season, and that contracts are now being made with farmers for the growing of large quantities for the coming season; if so, whether mustard is to be treated as an article of necessity; and, if not, will he consider the advisability of taking steps that will ensure the growth of wheat or other grain of national importance on this land?

Mr. Acland: The question which my hon. Friend raises is important and will be closely examined. Mustard certainly cannot be considered a national necessity in the same sense as wheat, and farmers would, I think, be wise not to assume that the acreage which they may place under mustard, in excess at any rate of that normally grown, will be specially profitable to them next season. It must not, however, be supposed that all the mustard is grown for use as a condiment. It is also grown as a catch crop or for green manure.

Chocolate Manufacture.—Sir P. Magnus (14th December) asked whether, having regard to the shortage in the supply of milk, steps will be taken to prevent certain chocolate manufacturers, not only during the months of December to February, but during the remaining nine or ten months of the year, from buying up the supply of milk of entire districts to be used for their own manufacturing purposes?

Captain Bathurst: Should the supply of fresh milk be insufficient, either generally or in any particular district, there is power under the Defence of the Realm Regulations to prohibit the use of milk for such purposes as those specified in the question, and this power will be used in any such case. On the instruction of the Food Controller an Order restricting the use of milk for chocolate is being prepared.*

German Prisoners of War (Employment).—Major Astor (20th December) asked the Home Secretary whether farmers wishing to employ German prisoners, either military or civilian, have to obtain the sanction of the local police?

Sir G. Cave: As regards civilians, the answer is in the negative. The Home Office is not concerned with military prisoners. Farmers wishing to employ civilian prisoners of war in the production of food have only to apply to the Home Office. The Home Office uses its

* See p. 1005.

discretion as to consulting the police before the men are sent out, but invariably informs the police when they are sent, and requests them to return the men to the camp if they should prove unsatisfactory in any way.

Major Astor: Can the police refuse to sanction the employment of such prisoners if the Home Office approve?

Sir G. Cave: No, Sir.

Sugar for Bees.—Captain Bathurst, replying to Sir Walter Essex (21st December), said: The Royal Commission on the Sugar Supply have arranged to grant a quantity of sugar in all not to exceed 50 tons for the purpose of feeding bees in the United Kingdom. Such sugar will only be available in the form of bee candy. Its proper use will be safeguarded by medication under the advice of the Bee Experts of the Board of Agriculture, and its manufacture and sale have been undertaken for the Departments concerned by Messrs. Sydney Pascall and Sons, Limited, Blackfriars, to whom all applications, whether from persons in the trade or private individuals, should be addressed.

Tuberculosis (in Cattle) Order.—Mr. Rowntree (22nd December) asked the Secretary to the Local Government Board whether, as a result of the suspension of the Tuberculosis Order, 1914, and of the tuberculosis test for animals providing milk and food, infected milk can now be sold for human consumption; and whether, in view of the importance to the nation of a healthy child life, he can see his way to reintroduce the Order?

Sir R. Winfrey: The hon. Member is, I think, misinformed as to the effect of the withdrawal of the Tuberculosis (in Cattle) Order. The result which he incorrectly ascribes to it, namely, the sale of infected milk for human consumption, is restrained by the Dairies, Cowsheds and Milkshops Orders of the Local Government Board, and by various local Acts. The Tuberculosis (in Cattle) Order was withdrawn soon after the outbreak of war, and it is not at present proposed to bring it again into operation until after the War.

Use of Commons.—Mr. Acland gave the following reply to a question by Mr. Cowan (14th December) as to the restoration and use of commons:

The right of the Board and of those claiming under them to retain possession of any common land taken under the Order in Council terminates at the end of the War, and it is only proposed that power should be obtained to continue in occupation for such further period as may be necessary to secure any annual crops growing on the land when the War ends. Each application to take any portion of a common will be considered on its merits, with due regard to the interests of the commoners and of the public, and the Board will not give their consent unless they are satisfied that no other unoccupied land is available for the purpose.

Sir R. Winfrey, replying to Sir W. Byles (18th December), stated that common land would not be taken for food production where other suitable land was available, and, in reply to Mr. W. Thorne, that land out of cultivation would be taken before common land.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Development of an American Linen Industry.—A Report published by the United States Bureau of Foreign and Domestic Commerce (Department of Commerce) discusses the question of the development of a linen industry in the United States. Before the War, imports of linen goods into the United States were valued at from £5,000,000 to £6,000,000 annually and were increasing; at present, imported linen goods are scarce and high in price, and the opportunity for developing the industry in the United States seems favourable.

The Report points out that flax-growing for seed and flax-growing for fibre are separate industries, and a decision must be made as to which is to be the more important product. Of some 3,000,000 acres under flax in the United States in 1915, the Department of Agriculture estimates that only 2,000 acres were grown for fibre. The great problem is so to arrange that the farmer may confine himself to the agricultural part of the industry, this being thought to be the only condition on which he will take up flax-growing for fibre, leaving to the manufacturer the preparation of the fibre for the spinner. This preparation involves several processes of which retting is one. Retting requires a considerable amount of cheap labour and much time, and is, in addition, a most disagreeable process. Efforts are therefore being made to discover some chemical process of retting that can be carried out at a factory; some progress is already being made in this direction, and at least two concerns are now buying flax stalks from the growers for further treatment; one of the new concerns is now selling chemically-retted fibre to Europe, and the other is making coarse linens for use in clothing and for curtains.

Even if the effort to produce a good American linen proves successful, there will still remain the problem of finding a market for it, there being at present a prejudice in favour of the imported product.

Karakul Sheep in Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that experiments in the breeding and rearing of Karakul sheep, the pelts of which are commonly known as Persian lamb fur, are being conducted by a farmer near Wyoming, Ontario. It is stated that by crossing the Karakul sheep with long wool Canadian sheep, Persian lamb pelts equal to the pure bred Karakul can be obtained. (*Board of Trade Journal*, October, 19th, 1916.)

Importation of Plants into the Bahamas.—The following is a summary of rules made by the Board of Agriculture of the Bahamas under the Plants Protection Act, 1916, regarding the importation of plants into the Bahamas:—

(1) Plants may only be imported through the Port of Nassau unless special permission from the Board of Agriculture has been obtained to land the plants elsewhere. They must be delivered to the Controller of Customs on arrival.

(2) If the plants are accompanied by a certificate from a recognised State Authority to the effect that the nursery, field, plantation or land from which the plants come is free from any harmful or dangerous disease, the plants may be delivered to the importer without undergoing disinfection or fumigation.

(3) The Board may cause any plants imported to be fumigated, disinfected, cleansed, purified and treated at the expense of the importer

in such manner as may be considered adequate for the destruction of any vegetable or insect pests. The Government are not liable for any damage which may be occasioned by such treatment.

(4) All plants and packages may be seized and destroyed or otherwise dealt with.

(5) All plants must be moved from the place of fumigation or other treatment by the importer within 24 hours' notice, otherwise the plants are liable to be destroyed.

(6) The importer may be required to keep the Board informed as to the disposal of any disinfected or treated plants.

(7) Plants imported through the Post Office must be notified to the Board by the importer, who shall not take possession of them until an inspector's certificate has been issued.

Importation of Strawberry Plants into the United States.—It has recently been decided by the United States Federal Horticultural Board that, with regard to the regulations as to importation, the term "nursery stock" includes strawberry plants. The regulations relating to the importation of nursery stock into the United States were given in this *Journal* for December, 1912, p. 280, May, 1913, p. 166, and August, 1914, p. 458, this last notice giving the arrangements made by the Board for the issue of certificates for this purpose.

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for December, 1916, issued by the International Institute of Agriculture, contains particulars concerning the production of cereal crops during 1916. The countries in respect of which data are available are as follows:—

In *Europe*.—Denmark, Spain, France, Great Britain, Ireland, Italy, Norway, Netherlands, Rumania, Russia in Europe (48 Governments), Switzerland; in *America*—Canada, United States; in *Asia*—British India, Japan; in *Africa*—Egypt, Tunis.

Wheat.—The total production in the above-mentioned countries is estimated at 309,665,000 qr. in 1916, compared with 412,962,000 qr. in 1915, a decrease of 25·0 per cent., the area sown being smaller by 11·8 per cent.

Rye.—In the above-mentioned countries, excluding Great Britain, Rumania, British India, Japan, Egypt and Tunis, the total production is placed at 115,344,000 qr. in 1916, against 121,140,000 qr. in 1915, a reduction of 4·8 per cent., the area sown showing a decrease of 3·8 per cent.

Barley.—In the specified countries, exclusive of British India, the production is estimated to amount to 123,020,000 qr. in 1916, against 135,564,000 qr. in 1915, or a decrease of 9·3 per cent., while the area sown was smaller by 3·1 per cent.

Oats.—The total production in the above-named countries, with the exception of British India, Japan and Egypt, is estimated at 323,813,000 qr. in 1916, or a reduction of 13·4 per cent. compared with the previous year, when it amounted to 374,082,000 qr., while the area sown was practically the same for both the years under consideration.

Maize.—In Italy, Russia in Europe (48 Governments) Switzerland, Canada, United States and Japan, the production is placed at 320,098,000 qr. in 1916, compared with 381,758,000 qr. in 1915, the decrease being equal to 16·2 per cent., while the area sown was smaller by 2·3 per cent.

Southern Hemisphere.—The production of wheat in Australia is estimated at 18,587,000 qr. in 1916-17, against 17,870,000 qr. in 1915-16, an increase of 4·0 per cent.

Russia.—According to reports of Tax Inspectors the condition of autumn-sown crops is bad in 9 districts, medium in 33 districts, satisfactory in 301 districts, and good in 124 districts of European Russia. In the second half of September cold, unfavourable weather prevailed over the whole of the country except the southern zone. Although the early frosts stopped the growth of the crops, little damage was inflicted as they were sufficiently developed in the whole of northern and middle Russia. In the south, rains and warm weather allowed sowing to proceed until the end of October, and the crops have developed normally. (*Broomhall's Corn Trade News*, 6th December.)

According to a report received from His Majesty's Commercial Attaché at Petrograd, dated the 8th November, the linseed crop in Russia in 1916 was below average, whilst the crop of hemp seed was generally above average. (*Board of Trade Journal*, 14th December).

United States.—According to the final estimates of the Bureau of Statistics of the Department of Agriculture the production of wheat in the United States in 1916 was 639,880,000 bush., as compared with 1,011,505,000 bush. in 1915; oats, 1,252,000,000 bush. against 1,540,362,000 bush.; maize, 2,573,200,000 bush. against 3,054,535,000 bush.: barley, 180,930,000 bush. against 237,009,000 bush.; linseed 15,459,000 bush. against 13,845,000 bush.; and potatoes, 285,437,000 bush. against 359,103,000 bush. in 1915. (*The London Grain, Seed and Oil Reporter*, 15th December.)

The Crop Reporting Board of the Bureau of Statistics estimates that the area of wheat sown this autumn was 40,090,000 acres, or 2·3 per cent. more than in 1915, whilst the condition on 1st December was 85·7 against 87·7 a year ago. The area of autumn rye is estimated at 4,214,000 acres, or 21·3 per cent. more than last year, whilst the condition of the crop on 1st December was 88·8 against 91·5 a year previously. (*The London Grain, Seed and Oil Reporter*, 18th December.)

Argentina.—The preliminary official estimates of this year's crops are as follows:—Wheat, 9,670,000 qr. against 21,560,000 qr. last season; oats, 3,540,000 qr. against 7,925,000 qr.; and linseed, 134,000 tons against 998,000 tons last season. (*The London Grain, Seed and Oil Reporter*, 18th December.)

India.—According to the first Government forecast the area sown with wheat in the Punjab is 10,891,000 acres against 9,509,000 acres, the first estimate, and 10,256,000 acres, the final return for 1915-16. The conditions were favourable and sowing was proceeding at the date of the estimate. In the North-West Frontier Province the estimated area sown is 1,916,000 acres against 824,000 acres, the first estimate, and 859,000 acres, the final return last season.

Agricultural Conditions in England and Wales on 1st January.

THE Crop Reporters of the Board, in reporting on the crops and agricultural conditions on the 1st January, generally state that the weather during December greatly hindered work on the land. In some districts the first fortnight was fine enough to allow of some progress being made, but in most parts the weather was too stormy for much to be done, and later there were frosts. Only a comparatively small area was consequently sown with wheat, and it is estimated that by the end of the year little over two-thirds of the area intended for this crop had been got in; while the total area sown is still, as was the case last month, nearly 15 per cent. less than at the corresponding date last year. The early sown wheat is quite satisfactory, but that sown later is germinating very slowly, and, where it is above ground, it is often poor.

Seeds are practically everywhere a good plant, healthy and vigorous, although the sharp weather at the end of the month checked their growth somewhat.

Turnips and swedes are generally keeping well; they are satisfactory crops. In many districts more of these roots are being left to be fed off in the ground than usual, and fewer have been lifted.

Reports on the condition of ewes are quite satisfactory, and other live stock are also in good condition. There is generally a sufficiency of home-grown winter keep.

Agricultural Labour in England and Wales during December.

ACCORDING to statements in the Board's *Monthly Agricultural Report* of 1st January, 1917, the supply of labour was everywhere still very deficient. The following are particulars for the different districts:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of both skilled and casual labour was deficient.

Lancashire and Cheshire.—The supply was everywhere short, but the deficiency in several districts was not seriously felt owing to the difficulty of getting on the land caused by the bad weather.

Yorkshire.—The supply was very deficient throughout the county.

Shropshire and Stafford.—The supply was everywhere very deficient.

Derby, Nottingham, Leicester and Rutland.—The supply of labour was deficient throughout the division.

Lincoln and Norfolk.—The shortage was everywhere pronounced, and in some districts wages had again advanced.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was deficient, the scarcity of horsemen being especially felt with field work so much in arrears. Casual labour was also difficult to obtain.

Bedford, Northampton, and Warwick.—There was a deficiency in the supply of labour throughout the division, casual labour for threshing, potato sorting and root pulling being difficult to obtain.

Buckingham, Oxford, and Berkshire.—The supply of labour was very deficient, particularly of skilled men.

Worcester, Hereford, and Gloucester.—Labour was deficient throughout the whole division.

Cornwall, Devon, and Somerset.—The supply of labour was everywhere deficient, though the shortage had not been so acute in several districts owing to the adverse weather

Dorset, Wiltshire and Hampshire.—The supply of labour was short throughout the whole district.

Surrey, Kent, and Sussex.—The supply of labour was very deficient, the small numbers of horsemen being most keenly felt.

Essex, Hertford, and Middlesex.—The supply of labour was short throughout the division.

North Wales.—Labour was generally scarce, but the shortage had not been severely felt during the month owing to the unfavourable weather conditions for autumn work.

Mid Wales.—There was a decided shortage in the supply of labour, especially casual labour, but little field work was possible during December.

South Wales.—Farmers were short of labour, and casual workers in particular are difficult to obtain.

THE following statement shows that according to the information in the possession of the Board on 1st January, 1917, certain diseases of animals existed in the countries specified:—

Prevalence of Animal Diseases on the Continent.

Austria (on the 29th November).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Denmark (month of October). — Anthrax, Foot-and-Mouth Disease, Swine Fever.

France (for the period 3rd—16th December).—Anthrax, Black-leg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 5th—30th November).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (month of November).—Anthrax, Foot-and-Mouth Disease, Foot-rot, Swine Erysipelas.

Hungary (on the 29th November).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 27th November—3rd December).—Anthrax, Black-leg, Foot-and-Mouth Disease (1,895 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of November).—Anthrax, Black-leg, Swine Fever.

Russia (month of August).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (77,040 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Sweden (month of November).—Anthrax, Black-leg, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

Switzerland (for the period 11th—17th December).—Anthrax, Black-leg, Foot-and-Mouth Disease (15 "étables" entailing 115 animals, of which 15 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Rumania, Serbia, Spain.

The Weather in England during December.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.		Rainfall. Diff. from Average.	No. of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 2nd Dec.:								
England, N.E. ...	39·3	−1·8	0·16	4	−8	2	1·5	0·0
England, E.	37·5	−3·0	0·11	3	−10	2	1·7	+0·1
Midland Counties ...	37·5	−2·8	0·04	1	−12	1	1·2	−0·2
England, S.E. ...	37·9	−4·5	0·02	1	−15	1	2·1	+0·5
England, N.W. ...	42·1	−0·1	0·44	11	−11	4	1·5	+0·2
England, S.W. ...	40·9	−2·8	0·08	2	−23	1	2·7	+1·0
English Channel ...	42·0	−4·3	0·15	4	−39	2	3·7	+1·7
Week ending 9th Dec.:								
England, N.E. ...	36·8	−3·2	0·77	19	+ 5	4	1·8	+0·5
England, E.	37·5	−2·1	0·52	13	− 1	4	0·7	−0·7
Midland Counties ...	34·5	−5·0	0·42	11	− 4	3	1·8	+0·5
England, S.E. ...	37·4	−4·3	0·45	11	− 7	3	1·8	+0·3
England, N.W. ...	37·0	−4·5	0·61	16	− 7	5	2·2	+1·1
England, S.W. ...	38·3	−4·8	0.73	18	−11	4	2·5	+0·9
English Channel ...	44·0	−2·7	0·70	18	− 9	4	2·3	+0·4
Week ending 16th Dec.:								
England, N.E. ...	35·7	−3·4	1·02	26	+11	6	1·0	−0·2
England, E.	35·6	−3·4	0·51	13	+ 1	4	0·5	−0·9
Midland Counties ...	32·7	−6·2	0·17	4	−10	3	0·5	−0·7
England, S.E. ...	35·0	−6·2	0·59	15	0	4	0·4	−1·1
England, N.W. ...	34·3	−6·3	0·20	5	−15	4	1·6	+0·6
England, S.W. ...	34·5	−8·1	0·32	8	−19	3	1·9	+0·4
English Channel ...	40·8	−5·4	0·94	23	− 1	7	2·2	+0·4
Week ending 23rd Dec.:								
England, N.E. ...	32·9	−5·5	0·83	21	+ 9	5	0·4	−0·8
England, E.	35·0	−3·0	1·17	30	+21	5	0·6	−0·7
Midland Counties ...	32·7	−5·2	1·39	35	+23	6	0·4	−0·7
England, S.E. ...	37·2	−3·0	1·80	46	+34	6	0·9	−0·5
England, N.W. ...	35·2	−4·5	0·95	24	+ 7	5	0·9	0·0
England, S.W. ...	37·0	−4·8	1·82	46	+23	6	2·6	+1·2
English Channel ...	42·8	−2·7	1·64	42	+23	6	3·1	+1·3
Week ending 30th Dec.:								
England, N.E. ..	39·3	+1·4	0·38	10	0	4	1·4	+0·3
England, E.	39·3	+1·8	0·58	15	+ 5	5	1·6	+0·3
Midland Counties ...	39·0	+1·6	0·61	16	+ 3	4	0·9	−0·2
England, S.E.... ...	40·6	+1·0	0·91	23	+10	4	1·5	+0·1
England, N.W. ...	41·0	+1·6	1·11	28	+11	5	1·3	+0·4
England, S.W. ...	42·0	+0·7	1·44	37	+13	5	1·5	+0·1
English Channel ...	46·2	+1·2	1·56	39	+19	6	1·3	−0·6

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

Disease.	December.		Twelve Months ended December.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	74	47	571	575
Animals attacked	97	47	687	641
Foot-and-Mouth Disease:—				
Outbreaks	—	8	1	56
Animals attacked	—	33	24	702
Glanders (including Farcy):—				
Outbreaks...	1	3	47	49
Animals attacked	3	5	117	85
Parasitic Mange:—				
Outbreaks	211	159	2,156	*933
Animals attacked	411	334	4,680	*1,995
Sheep-Scab:—				
Outbreaks	163	69	426	257
Swine Fever:—				
Outbreaks	274	280	4,331	3,994
Swine Slaughtered as diseased or exposed to infection	124	814	9,168	16,702

* The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

Disease.	December.		Twelve Months ended December.	
	1916.	1915.	1916.	1915.
Anthrax:—				
Outbreaks	—	—	3	2
Animals attacked	—	—	7	2
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	3	3	62	71
Sheep-Scab:—				
Outbreaks	110	34	525	412
Swine Fever:—				
Outbreaks	25	11	319	247
Swine Slaughtered as diseased or exposed to infection	201	54	1,910	1,361

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in December and November, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	December.		November.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	15 6	14 5	13 6	12 11
Herefords	15 1	13 11	13 5	12 5
Shorthorns	14 10	13 7	13 6	12 3
Devons	14 7	13 4	13 4	11 9
Welsh Runts	14 10	13 11	13 1	12 1
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	—	—	11¾	11
Sheep :—				
Downs	14½	13	13¼	12
Longwools	13½	12¼	12½	11½
Cheviots	14½	13¼	13½	12½
Blackfaced	14	12¾	13¼	12½
Welsh	13¾	12½	12¼	10½
Cross-breds	14¼	13¼	13¼	12
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	13 3	12 4	12 9	12 1
Porkers	14 5	13 9	13 9	13 3
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	40 7	32 4	38 3	30 16
,, —Calvers ...	37 15	30 10	36 5	29 18
Other Breeds—In Milk ...	38 12	30 3	36 11	28 19
,, —Calvers ...	27 0	25 10	—	—
Calves for Rearing	3 9	2 12	3 8	2 14
Store Cattle :—				
Shorthorns—Yearlings ...	15 9	13 10	15 8	13 2
,, —Two-year-olds...	22 16	19 18	22 0	19 0
,, —Three-year-olds	31 1	26 2	29 1	25 0
Herefords —Two-year-olds...	23 10	21 2	24 9	20 11
Devons— ,,	24 2	20 7	22 18	18 3
Welsh Runts— ,,	22 5	19 1	21 8	18 8
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	62 0	52 9	57 5	49 0
Store Pigs :—				
8 to 12 weeks old	24 0	16 5	27 8	19 10
12 to 16 ,, ,, ...	42 7	31 10	47 3	35 10

* Estimated carcase weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in December, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—											
English	1st	101	0	103	0	—		102	0	102	6
	2nd	95	0	98	6	—		95	0	98	0
Cow and Bull	1st	88	6	92	0	84	0	87	0	91	0
	2nd	81	6	87	0	71	0	81	6	82	6
Irish: Port Killed	1st	100	6	99	0	97	0	99	6	99	0
	2nd	91	0	92	6	89	0	92	6	95	0
Argentine Frozen—											
Hind Quarters	1st	98	0	—		—		—		—	
Fore ,, ...	1st	79	6	—		—		—		—	
Argentine Chilled—											
Hind Quarters	1st	98	6	101	0	97	0	97	6	97	0
Fore ,, ...	1st	78	6	78	0	78	0	77	0	78	0
American Chilled—											
Hind Quarters	1st	—		—		—		100	6	—	
Fore ,, ...	1st	—		—		—		79	6	—	
VEAL:—											
British	1st	109	6	99	0	107	6	116	6	—	
	2nd	100	6	88	6	97	0	98	0	93	6
Foreign...	1st	—		—		—		—		—	
MUTTON:—											
Scotch	1st	115	6	—		113	0	117	0	121	6
	2nd	111	0	—		106	0	108	0	115	0
English...	1st	115	6	127	0	—		113	6	112	0
	2nd	111	0	114	6	—		104	6	107	6
Irish: Port Killed	1st	111	6	—		104	6	104	6	107	6
	2nd	108	6	—		98	0	98	0	102	6
Dutch	1st	—		—		—		97	0	—	
Argentine Frozen	1st	83	6	80	0	79	6	82	0	79	6
New Zealand ,, ...	1st	79	6	81	6	79	6	83	0	78	6
LAMB:—											
British	1st	—		—		—		—		—	
	2nd	—		—		—		—		—	
New Zealand	1st	95	6	93	6	94	6	91	0	94	6
Australian	1st	—		—		—		—		—	
Argentine	1st	89	0	—		88	0	90	0	88	0
PORK:—											
British	1st	130	6	126	0	121	6	118	0	126	0
	2nd	118	0	116	6	111	0	104	0	113	6
Frozen	1st	95	6	94	0	99	6	95	6	98	0

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in December, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	23 9	22 9	—	—	23 3	22 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	218 0	214 6	217 0	214 0	216 0	212 0
,, Factory	194 0	187 6	192 0	188 0	196 0	190 0
Danish...	—	—	224 0	220 0	222 0	219 6
French...	—	—	—	—	209 6	204 6
Dutch	—	—	—	—	211 6	208 0
American	198 0	194 0	196 0	192 0	194 6	189 6
Australian	213 6	209 6	216 0	212 0	212 0	206 0
New Zealand	220 0	218 0	220 0	218 0	215 6	211 6
Argentine	—	—	—	—	210 6	206 6
CHEESE :—						
British—						
Cheddar	135 0	130 6	133 6	129 6	138 0	132 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	157 6	152 6	158 0	149 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	130 6	128 0	132 0	127 0	131 0	127 0
BACON :—						
Irish (Green)	124 0	117 0	119 0	115 0	120 0	114 6
Canadian (Green sides)	112 0	108 0	112 0	106 6	112 0	107 6
HAMS :—						
York (Dried or Smoked)	168 0	162 0	—	—	168 0	161 6
Irish (Dried or Smoked)	—	—	—	—	166 0	160 0
American (Green) (long cut)	110 6	107 6	109 0	105 6	111 6	107 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	—	—	—	—	35 7	32 11
Irish	31 10	—	30 10	29 4	32 3	30 0
American	21 9	—	18 11	18 1	21 3	19 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	228 6	216 0	196 6	186 6	240 0	222 6
Edward VII.	244 0	224 6	213 6	206 6	235 0	220 6
Up-to-Date	232 6	212 6	208 6	198 6	228 6	216 0
HAY :—						
Clover	—	—	150 0	140 0	143 6	133 6
Meadow	—	—	—	—	143 0	133 6

CORN PRICES.

SEPTENNIAL, ANNUAL AND QUARTERLY AVERAGES.

STATEMENT showing what has been during **seven years**, ending *Christmas Day, 1916, the average price of an Imperial bushel of British* wheat, barley, and oats, computed from the weekly averages of corn *returns, for the purposes of the Tithe Acts, pursuant to the Corn Returns Act, 1882.*

Wheat.	Barley.	Oats.
s. d.	*s. d.*	*s. d.*
4 11	4 0¼	2 10½

NOTE.—The value of £100 Tithe Rent-charge for the year 1917, as varied in accordance with the septennial average prices of corn shown above, is calculated at £92 1*s.* 0¾*d.*

Statement showing the average price of British corn, per quarter (Imperial measure) for the **quarter** ending Christmas, 1916, pursuant to the Corn Returns Act, 1882.

Wheat.	Barley.	Oats.
s. d.	*s. d.*	*s. d.*
68 2	60 1	38 4

Statement showing the average price of an Imperial bushel of British corn, for the **year** ending Christmas, 1916, pursuant to the Corn Returns Act, 1882.

Wheat.	Barley.	Oats.
s. d.	*s. d.*	*s. d.*
7 3½	6 8¼	4 2

Comparative statement, for the years 1910 to 1916, of the quantities sold and the average prices per quarter (Imperial measure) of British corn as returned under the Corn Returns Act, 1882.

Year.	Quantities Sold.			Average Price.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	qr.	qr.	qr.	*s. d.*	*s. d.*	*s. d.*
1910 ..	3,072,523	3,205,203	791,121	31 8	23 1	17 4
1911 ..	3,140,257	3,123,986	858,341	31 8	27 3	18 10
1912 ..	2,365,596	2,165,572	630,755	34 9	30 8	21 6
1913 ..	2,511,297	2,948,930	639,298	31 8	27 3	19 1
1914 ..	3,027,976	3,403,072	1,164,361	34 11	27 2	20 11
1915 ..	3,225,198	2,552,128	1,181,480	52 10	37 4	30 2
1916 ..	3,600,391	2,182,218	1,129,096	58 5	53 6	33 5

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1914, 1915 and 1916.

Weeks ended (*in* 1916).	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan 8...	30	11	46	2	55	8	25	11	29	7	47	8	18	4	26	5	31	5
,, 15...	31	0	48	9	56	7	26	0	30	5	48	6	18	6	27	6	31	11
,, 22...	30	11	51	6	57	2	26	3	31	3	49	6	18	11	28	10	32	6
,, 29...	31	1	52	8	58	0	26	6	32	5	51	0	19	1	29	10	32	11
Feb. 5...	31	0	53	3	58	3	26	7	33	7	52	5	18	9	30	3	32	4
,, 12...	31	0	54	8	57	6	26	7	34	7	52	10	18	11	31	1	32	2
,, 19...	31	0	56	0	56	11	26	7	34	11	53	6	18	11	31	5	31	9
,, 26...	31	0	56	0	58	2	26	6	35	3	54	2	18	11	31	8	32	2
Mar. 4...	31	5	55	11	59	4	26	2	34	6	55	7	18	9	31	8	32	4
,, 11...	31	6	54	8	58	2	26	0	33	5	55	6	18	7	31	0	32	3
,, 18...	31	5	53	9	57	9	25	8	32	2	55	4	18	6	30	7	31	10
,, 25...	31	4	54	3	55	11	25	7	31	11	54	6	18	8	30	6	31	4
Apl. 1...	31	6	54	6	53	6	25	6	31	9	53	8	18	5	30	6	30	5
,, 8...	31	5	54	9	51	8	26	8	31	3	53	7	18	4	30	4	30	1
,, 15...	31	7	55	4	53	2	25	4	30	10	53	1	18	4	30	5	30	7
,, 22...	31	9	56	5	55	3	26	6	31	5	52	10	18	5	30	11	31	8
,, 29...	31	9	58	3	56	3	26	0	32	7	53	5	18	5	31	5	32	4
May 6...	32	2	60	5	55	7	25	6	33	3	53	1	18	9	32	4	32	10
,, 13...	32	7	61	7	55	5	26	3	34	0	53	5	18	11	32	5	33	1
,, 20...	33	0	62	0	55	0	25	10	34	1	52	10	19	0	32	8	33	0
,, 27...	33	9	61	11	54	7	26	1	34	8	52	9	19	4	32	7	33	4
June 3...	34	0	61	9	53	3	25	11	35	4	53	9	19	4	32	5	33	3
,, 10...	34	1	60	1	51	2	24	11	34	5	52	8	19	8	32	4	32	7
,, 17...	34	1	56	1	48	10	25	10	34	3	50	9	19	9	31	9	32	1
,, 24...	34	3	52	0	47	6	25	4	34	4	49	10	20	0	31	9	31	3
July 1...	34	4	49	5	46	3	24	6	35	3	49	1	19	9	31	1	30	10
,, 8...	34	2	50	1	46	3	24	9	34	7	45	6	20	0	31	6	30	8
,, 15...	34	1	52	7	48	11	24	2	35	8	47	5	19	10	31	6	31	6
,, 22...	34	0	53	10	51	6	24	7	35	10	48	8	19	9	32	1	32	3
,, 29...	34	2	55	3	53	5	25	9	36	1	47	2	19	8	31	1	32	5
Aug. 5...	34	9	55	4	55	1	25	2	35	7	46	1	19	1	31	5	32	9
,, 12...	40	3	55	2	56	7	29	4	37	0	46	11	25	1	31	7	31	2
,, 19...	38	9	54	3	58	1	29	10	39	4	48	0	24	3	31	4	30	8
,, 26...	36	2	51	11	59	0	30	3	38	3	47	1	23	5	30	0	31	6
Sept. 2...	36	5	45	3	59	4	30	6	38	1	48	5	23	9	26	10	30	5
,, 9...	37	10	43	0	59	3	29	11	37	11	51	7	23	11	26	8	31	1
,, 16...	38	3	42	9	59	11	29	5	39	0	52	6	23	8	26	4	30	9
,, 23...	37	6	43	3	59	4	29	3	39	8	53	3	23	3	26	1	30	9
,, 30...	37	1	43	5	58	10	29	1	40	4	54	1	22	9	26	5	31	1
Oct. 7...	36	8	44	1	59	2	28	10	41	0	54	5	22	5	26	5	30	9
,, 14...	36	7	45	9	59	7	28	8	42	3	53	10	22	4	27	1	31	6
,, 21...	37	2	48	2	60	9	28	7	44	0	53	8	22	5	28	1	31	11
,, 28...	37	10	50	3	62	10	28	3	46	2	54	6	23	7	29	1	32	10
Nov. 4...	38	8	51	6	66	7	28	6	47	3	56	2	23	7	30	4	34	0
,, 11...	39	8	52	8	69	8	29	0	47	5	58	0	24	8	30	11	35	8
,, 18...	41	0	53	6	70	9	29	8	47	11	59	8	25	5	31	3	37	8
,, 25...	41	11	54	2	70	8	30	3	48	7	61	8	25	8	31	1	39	7
Dec. 2...	42	2	53	7	71	3	30	2	48	11	63	1	25	9	30	11	41	4
,, 9...	42	1	52	10	72	1	29	11	47	10	65	6	25	9	30	4	44	1
,, 16...	42	7	53	11	73	2	29	8	47	5	66	5	25	9	30	6	45	10
,, 23...	43	3	53	10	74	8	29	9	47	2	67	3	25	11	30	7	46	5
,, 30...	44	4	54	9	75	10	29	10	47	5	67	5	26	6	30	10	47	4

NOTE.—Returns of purchases by weight or weighed measure are converted to

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of December, 1914, 1915, and 1916.

—	WHEAT.						BARLEY.						OATS.					
	1914.		1915.		1916.		1914.		1915.		1916.		1914.		1915.		1916.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	44	1	55	1	74	11	31	3	45	11	67	9	27	1	32	6	44	4
Norwich ...	41	11	52	11	72	6	29	6	47	0	65	7	26	0	30	8	44	10
Peterborough	42	5	53	2	72	8	29	5	47	5	66	3	25	8	31	1	46	2
Lincoln ...	43	0	53	10	73	1	29	8	47	1	66	9	25	5	30	8	46	1
Doncaster ...	42	8	53	10	72	2	28	7	46	9	65	3	25	0	30	2	45	10
Salisbury ...	42	3	53	0	73	11	30	5	48	9	66	5	26	7	31	1	44	11

ADDITIONS TO THE LIBRARY.

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University of Leeds and Yorkshire Council for Agricultural Education.—Bull. 98 :—Cost of Food in the Production of Milk. Fourth Report. (37 pp.) Leeds, 1915. [63.711; 63.714.]

National Clean Milk Society.—Recommendations for the Care of Cows and of Milk which should be observed by Farmers and Dairymen. (4 pp.) 1916. [614.32.]

Birds, Poultry, and Bees—

University of Leeds and Yorkshire Council for Agricultural Education.—Bull. 99 :—Poultry - keeping in War-time. (3 pp.) [63.651(04).] Bull. 102 :—Chicken Rearing. (4 pp.) [63.651(04).] Leeds, 1916.

Forestry—

Stebbing, E. P.—British Forestry : Its Present Position and Outlook after the War. (257 pp.) London : John Murray, 1916. 6*s.* net. [63.49(42).]

Engineering—

Derbyshire County Council, War Agricultural Committee.—Farm Labour-saving Machines, Implements, and Devices. (34 pp.) 1916. [63.17(04).]

Jackman, W. T.—Transportation in Modern England. 2 vols. (820 pp.) Cambridge : University Press, 1916. 24*s.* net the two vols. [38.]

University of Leeds and Yorkshire Council for Agricultural Education.—Bull. 100 :—Report on Demonstration with Motor Tractors at York, 1915. (24 pp.) Leeds, 1916. [63.17(04).]

Economics—

Land Agents' Society.—Facts about Land. A Reply to "The Land," The Report of the Unofficial Land Enquiry Committee. (319 pp.) London : John Murray, 1916. 2*s.* 6*d.* net. [338.1.]

Moore, H. E.—Farm Work for Discharged Soldiers. (31 pp.) London : P. S. King & Son, 1916. 6*d.* net. (331 ; 325.]

Weld, L. D. H.—The Marketing of Farm Products. (483 pp.) New York : The Macmillan Company, 1916. 6*s.* 6*d.* net. [381.]

(4728) Wt. P. 13—50. 7,500. 1/17. J. T. & S., Ltd.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE

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AGRICULTURE AND THE WAR.

THE principal developments which have recently taken place in connection with the work of the Board of Agriculture and Fisheries have been addressed to the purpose of increasing home food production by farmers, allotment holders, and gardeners, and to persons in a position to keep pigs.

Formation of a Food Production Department.—With this aim the President has established, within the Board, a Department of Food Production, the staff of which has been mainly recruited from the permanent staff of the Board. The Director of the new Department is Mr. T. H. Middleton, C.B., who has been for many years the Assistant Secretary of the Board's "Intelligence" Division. The Assistant Directors are Mr. F. L. C. Floud, who is another Assistant Secretary of the Board, and Mr. Sydney Mager, the Board's Senior Commissioner for Small Holdings. The Department is housed at 72, Victoria Street, S.W.

The Food Production Department will direct the distribution of labour so that available workers may be employed where most needed, will endeavour to secure the most economical use of fertilisers and feeding stuffs, and will attempt to arrange for the sowing of those varieties of crops which are likely to give the most satisfactory results.

The work will be organised partly in the country and partly in London. The counties of England and Wales will be grouped into 17 districts. A Commissioner will be appointed for each, and he will serve as an administrative link between the Board and the counties within his district.

County War Agricultural Committees.—In connection with this reorganisation and increase of the Departmental staff of the Board, provision has been made for the concentration, strengthening and extension of the organisation of the County

War Agricultural Committees. This organisation consists of:—

(1) A War Agricultural Committee for each county, or, where a county is administratively divided, *e.g.*, Yorkshire, for each division of the county.

(2) An Executive Committee of the War Agricultural Committee, consisting of from 4 to 7 county members who can devote time continuously to the work of increasing production, and including the local representative of the Board as an *ex officio* member.

The Cultivation of Lands Order, 1917, vests these Executive Committees with the powers conferred on the Board by Regulation 2M of the Defence of the Realm Regulations, 1914, and a Circular of Instructions (dated 23rd January, 1917) has been issued to the Committees for their guidance in the administration of the Order.*

The primary object which the Committees are directed to keep before them is to see that farmers are assisted and encouraged to cultivate the existing arable land on their farms in such manner as will secure the greatest possible output of those crops which are most valuable in the national interest at the present time, a list of which was given in Mr. Prothero's Memorandum addressed to War Agricultural Committees on 28th December, 1916.† In cases in which it is practicable and desirable that grass land should be broken up, the Order referred to above enables the Committees to do this, or to direct it to be done by the occupier, but they are to satisfy themselves in each case that the change of cultivation is in the national interest, and are not to sanction the breaking up of meadow land or grass land which can more profitably be used as pasture.

Schemes for the cultivation of derelict or waste land, which must involve considerable capital expenditure, are not to be undertaken without careful consideration, nor until the Committee have satisfied themselves that any labour or machinery at their disposal cannot more profitably be applied to land which is already under cultivation. In view of the shortage of labour, Committees have been warned, before undertaking to break up grass land or sanctioning such action, to consider whether it would not be more profitable to improve it as pasture.

The Executive Committees have power to enter on and inspect land, and to direct land to be cultivated in such specified manner as they may think desirable, in which case the occupier

* See pp. 1126 and 1128. † *Journal*, January, 1917, p. 1008.

will be relieved from any penalty for breach of contract with the owner involved in compliance with the Committee's direction; they have power to issue directions as to cultivation, for neglect of which the occupier will be guilty of a summary offence against the Defence of the Realm Regulations; also power themselves to enter on and cultivate land, to take possession of land, to undertake manuring and, where an occupier is not in a position to obtain fertilisers, to procure and, if necessary, apply them for him and allow a reasonable period for the repayment of the cost.

Many bodies are assisting or are prepared to assist the War Agricultural Committees. The Surveyors' Institution, the Land Agents' Society, the Tenant Right Valuers' Association, and the Land Valuation Department of the Inland Revenue, are all giving their help.

The War Agricultural Committees have begun, and some have completed a practical survey of land which is either uncultivated or under-cutivated, based upon local information. The Committees have been requested not to wait till their survey is complete, but to notify the Board of any areas inefficiently farmed which come under their notice in the progress of their survey. With two of these areas the Board are already dealing.

Organisation of the Food Production Department.—The office of the Food Production Department in London will be organised as follows: (*a*) As a "clearing house" for the War Agricultural Committees. Local wants in respect of labour, manure, seeds, etc., will thus be reported to the head of one of the sections of the Department. He will pass them to the heads of other sections dealing with labour, machinery, seeds, etc., whose business will be to provide what is asked for if this is possible. (*b*) The Office will have at disposal a highly skilled group of consultants on soils, manures, grasses, feeding stuffs, etc. Some of the most competent members of the staffs of the Institutes for Research in Agricultural Science and of the Agricultural Colleges have arranged to come to London for part or whole time work in the Department. Questions on technical points will be submitted to and dealt with by them, and every effort will be made to provide effective advice. (*c*) Where arrangements cannot be made through the County Executive Committees for the cultivation of unfarmed land the Department will be directly responsible for its cultivation. In such cases a scheme will be drawn up, and, as a rule, the carrying out of the scheme will be entrusted to a skilled local farmer.

(*d*) By the extension of schemes already in progress efforts will be made to increase cheese and egg production.

The immediate object of the Department is, of course, to assist farmers to make the most out of their land during 1917; but, concurrently, a survey is being undertaken and plans are being made for 1918. It is hoped that by looking well ahead it may be possible to secure a considerable increase of food production in the harvest of 1918.

Advisory Committee on Food Production.—To assist him in directing the policy of the new Department the President has set up an Advisory Committee on Food Production.* This Committee includes several of those who have served on the earlier committees constituted since the outbreak of war to deal with agricultural questions. The first purpose of the Committee is to advise on practical questions affecting the home production of food; but it is Mr. Prothero's hope that the institution of this Committee may also lead to marked progress in British farming after the conclusion of peace.

Labour.—Outside the new Department, the provision, as distinguished from the distribution, of labour, is assigned to the Board's Chief Agricultural Adviser, Mr. E. J. Cheney, who also, in collaboration with the War Office, deals with all questions coming to the Board affecting the relative claims of the Army and of Agriculture to the services of agricultural man-power; and, consequently, with the activities of the Board's representatives before Local and Appeal Tribunals, on Substitution Committees, in contact with Military Substitution Officers, and in connection with the census of men on the land recently taken by the War Office.

Contact and co-operation is also maintained with the Ministry of Labour and the Ministry of National Service.

Agricultural Machinery.—Mr. Cheney represents the Department in co-operation with the Ministry of Munitions in regard to the control, manufacture, and supply of agricultural machinery, and in all questions relating to the labour supply for mechanical cultivation.

The Board have obtained the leave of the Treasury to purchase tractors, and arrangements have been made, through the War Office, with the Director of Supply and Transport, that he should man these tractors (which will be worked through the War Agricultural Committees), keep them in repair at his

* See p. 1132 of this issue of the *Journal*.

repairing shops, and distribute the necessary petrol and lubricants through his depots. Four schools have been set up, and men will be passed through them, on an average, after a fortnight's training.

Women's Labour.—Further, in connection with the problem of labour supply, the establishment of a Woman's Labour Department under the Board has been approved by the Treasury, and the Department is now being organised. The Board have already taken over the responsibility for organising the supply of woman agricultural labour throughout the country, and much more complete provision is now being made for the carrying on of the work of the Women's Farm Labour Committees, parallel to the reinforcement of the War Agricultural Committees.

The purposes in view in establishing this new Department are:—

(1) Greatly to energise the local recruiting and organising work of the Women's Farm Labour Committees and their Parish Registrars for the supply to farmers of the services of women resident in the villages.

In October last the Board of Trade reported that 140,000 such women had been registered, of whom 72,000 had received certificates for work, and 62,000 armlets for 30 days' service. It should be possible to evoke a much greater effort in the course of the coming spring.

(2) To establish conditions of service which will, as far as possible, improve the conditions under which non-resident and town-bred women can be induced to give their services to agriculture. The Department aims at getting as many as 40,000 women from these sources.

These proposals involve a considerable multiplication of training centres and provision for the continuous employment and suitable lodging of women when trained.

The concession of the War Office, that, **where the male labour on a farm does not exceed the agreed scale, woman labour shall be supplementary to, and not in substitution for, male labour**, has made the farmers willing and anxious to employ women in full.

The Cultivation of Land in Urban Areas.—In connection with the effort to increase food production the work of the Board is being augmented by the operation of the Cultivation of Lands Order of 1916, issued on the 8th December, 1916, immediately before the constitution of the present Government, whereby Local

Authorities are empowered and encouraged to promote the occupation of vacant lands in urban and suburban areas for cultivation in allotments. This work is dealt with under the Food Production Department.

⁂ Full details of schemes of the Board having reference to the cultivation of land, the supply of labour and machines, the employment of women, the distribution of seed potatoes, etc., will be found in this issue of the *Journal*, p. 1121, *et seq.*, and in previous and subsequent issues under the heading "Official Notices and Circulars."

THE FOOD SUPPLY OF THE UNITED KINGDOM.

AT the request of the President of the Board of Trade, the Royal Society appointed in 1916 a Committee to draw up a report on the food supply of the United Kingdom. The Committee comprised the following members:—A. D. Waller, M.D., F.R.S., Professor of Physiology in the University of London, *Chairman;* W. J. Ashley, Ph.D., Professor of Commerce in the University of Birmingham; A. W. Flux, M.A., Board of Trade; A. D. Hall, M.A., F.R.S., Development Commissioner; F. G. Hopkins, M.D., D.Sc., F.R.C.P., F.R.S., Professor of Bio-Chemistry in the University of Cambridge; T. H. Middleton, C.B., Board of Agriculture and Fisheries; D. Noel Paton, M.D., F.R.C.P.E., F.R.S., Professor of Physiology in the University of Glasgow; W. H. Thompson, M.D., D.Sc., F.R.C.P.I., Professor of Physiology in the University of Dublin; T. B. Wood, M.A., Drapers' Professor of Agriculture in the University of Cambridge.

The real problem confronting the Committee was to suggest measures of economy by the rearrangement of methods of *production*, in the event of the food supply under present methods of production being in danger of falling below necessary requirements. The prevention of loss in present methods of *distribution* of food was not considered, and no suggestions were made with a view to influencing the *consumer* to exercise economy.

The Committee, however, extended their survey to a discussion of the food supply and food surplus of the United Kingdom both before and during the War.

Food Supply before the War.—To get the total food supply the surplus of imports over exports of food has to be added to

the home production of food. It is usually assumed that the statistics collected by the Board of Trade as to imports are fairly accurate, but the statistics of home production consist of estimates. The error in the figures of the total food supply is relatively very much less than in that of home food figures on account of the large and more accurate figures of imported food which are added. With this premise, the figures given by the Committee may be quoted. These figures show the quantities in metric tons (2,205 lb.) of food materials (imported *plus* home produced), and of the amounts of protein, fat and carbohydrate present. These quantities are the average amounts per annum for the five years, 1909—1913.

FOOD SUPPLY PER ANNUM BEFORE THE WAR.

Kind of Food.	Amounts of Food.	Protein.	Fat.	Carbohydrate.	Energy Value. Millions of Calories.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	
Cereals	4,865,000	549,000	63,000	3,628,000	17,712,000
Meat	2,685,000	356,000	799,000	—	8,890,000
Poultry and eggs, game and rabbits	331,000	42,000	31,000	—	461,000
Fish	848,400	91,000	17,000	—	531,000
Dairy produce (including lard and margarine)	5,231,800	199,000	686,000	258,000	8,253,004
Fruit	1,271,000	9,000	14,000	222,000	1,077,000
Vegetables	5.482,000	120,000	10,000	1,031,000	4,812,000
Sugar, including cocoa and chocolate	1,657,000	5,000	18,000	1,572,000	6,633,000
Cottage and farm produce not included above	—	67,000	13,000	551,000	2,655,000
Total	—	1,438,000	1,651,000	7,262,000	51,024,000
		gm.	gm.	gm.	calories.
Per head per day	—	87	100	440	3,091
Per "man" per day	—	113	130	571	4,009

The terms "protein," "fat," "carbohydrate" and "calories" may be explained. Protein, fat and carbohydrate are the three classes of nutrient substances contained in the food materials bread, meat, vegetables, etc. They are in small part building material of the living body, in large part fuel by the energy of which the muscular work of the body is done. Their energy is measured in heat-units or calories (a calorie is the quantity of heat required to raise a kilogramme of water one degree Centigrade), and it is reckoned that, in so far as they are oxidized in the living body, proteins and carbohydrates give rise to 4·1 calories per gramme, fat to 9·3 calories.

Of the three constituents protein is the most important; because it is, in the first instance, the chief building substance of the body, as well as incidentally a source of energy. It

also increases the rate of chemical change in the body, and thus facilitates the utilisation of other foods. Fat is a concentrated store of energy. Carbohydrate is the most bulky and most immediate source of the energy required for muscular work. Fat and carbohydrate can to some extent replace each other in a dietary.

The figures in the table showing the amount of protein, etc., available per head of the population per day have been obtained by dividing the totals by 45·2 million (the estimated population). The consumption of food by different classes of the population varies greatly in amount, so to get the amount available per male over 16 years of age the consumption of other classes has been taken as follows:—

Children 0 — 5 years,	0·4	of the "Man"	value.
,, 6 — 9 ,,	0·5	,,	,,
,, 10 — 13 ,,	0·6	,,	,,
Females 14 & 15 ,,	0·7	,,	,,
Males 14 & 15 ,,	0·8	,,	,,
Females 16 and above,	0·8	,,	,,

and in this way the figures per man per day in the tables were arrived at.

A full consideration of the dietary requirements of a nation for the most part engaged in active work has convinced the Committee that these requirements cannot be satisfactorily met on a less supply in the food as purchased than 100 grammes protein, 100 grammes fat, 500 grammes carbohydrate, equal *approximately to 3,400 calories per "man" per day, a "man"* being an average workman doing an average day's work. The Committee have adopted this as their minimum standard. It must be remembered that fats and carbohyrdates are inter-

Kind of Produce.	Energy Value. Millions of Calories.	
	Home Produce.	Imported.
Cereals	3,705,000	14,007,000
Meat	6,369.000	3,521,000
Poultry and eggs, game and rabbits	235,000	226,000
Fish	392,000	139,000
Dairy produce (including lard and margarine)	4,715.000	3,538,000
Fruit	168,000	909,000
Potatoes and other vegetables	4,054,000	758,000
Sugar, including cocoa and chocolate ..	—	6,633,000
Cottage and farm produce not included above	2,655,000	—
	21,293,000	29,731,000

changeable to a limited extent; that the figures refer to total food constituents as purchased and not to digestible constituents; and that no attempt has been made to correct for loss during distribution.

It will be seen that the food supply more than met the minimal physiological standard, and that there was wasted or consumed in excess of these requirements, of proteins 11 to 14 per cent., of fats 25 to 30 per cent., and of carbohydrates 10 to 14 per cent.

The table on p. 1048 shows that we depended on external sources for 57 per cent. of our total supply of energy.

As regards the protein supply, however, more was produced at home than was imported.

Food Supply in 1916.—*The Distribution of Food on the Assumption that the pre-War Supply is Maintained.*—For the purpose of this investigation the Committee estimated the total population at 46·5 million, including our fighting forces at home and abroad and the refugees and prisoners in this country. Calculated on the man-values already given, this is equivalent to 35·8 million "men." In the following calculations the men in military and naval establishments are assumed to total 4 million and the civil population to total 42·5 million, equivalent to 31·8 million "men." The rations for the fighting forces have been calculated from the Army rations and deducted from the total supplies (of 1909-13) and the civilian food consumption thus ascertained.

The following table gives the results:—

Total Amount of Food Available in Metric Tons per Year and the Amount of Food per "Man" per Day in Grammes at the Present Time Compared with that in 1909-13.

—	1909–1913.		1916. Population 46·5 Million at 0·77 Man Value. 35·8 Million "Men."			
			Military. 4 Million.		*Civil.* 35·8 — 4 = 31·8 Million "Men."	
	Total.	Per "Man." per Day.	Total.	Per "Man" per Day.*	Total.	Per "Man" per Day.
Protein	1,438,000	113	204,400	140	1,233,600	106
Fat	1,651,000	130	262,800	180	1,388,200	120
Carbohydrates ..	7,262,000	571	730,000	500	6,532,000	563
Calories	—	4,009	—	4,300	—	3,859

* Daily ration of 2 million British and Dominion troops, "Total, with extras," and 2 million on Army Rations (Home), 1916, "Total, with extras." The totals are calculated from the Army Rations.

The table shows that *on the pre-War basis of supply* the food available for the civil population would be more than sufficient, both as regards the supply of protein and of energy.

The Supply of Food at Present Available.—At the time the Committee considered this question (July, 1916), the evidence available was to the effect that there had been a small increase over food values in the year ended June, 1916, as compared with the pre-War period. Since that date, however, the position has altered for the worse, both as regards present supplies and prospects in the immediate future.

The remarks of the Committee as to the need for proper organisation of the distribution of food are sufficiently interesting to be quoted in full:—

"Up to the present (*i.e.*, July, 1916) the supply of food has provided a general margin of about 5 per cent. above the minimum necessary for proper nutrition, and rather more as regards the supply of energy, so that a reduction to this extent would still furnish amounts of the essential food constituents conforming to the minimal standard. Should such a reduction occur, it could be borne without serious injury to the community, *but only on the condition that steps were taken to ensure the equitable distribution of the available food throughout the population.*

"While the supply of food has, up to the present, been adequate for the support of the population, the rise in prices has accentuated the inequalities of distribution, which reduce the daily ration of many below the level of efficiency. Any curtailment of supplies, even to a limited extent, would result in the poorer classes obtaining less than is needful for safety should distribution remain unorganised.

"The Committee, as physiologists, desire to lay stress on the fact that in buying food the labouring population is buying energy—the power to do work. Increased cost of food (other things being equal) means increased cost of production. If the rising prices curtail for any class of the community its accustomed supply of food, its output of work will, of necessity, be reduced. It is important to remember that a slight reduction of food below the necessary amount causes a large diminution in the working efficiency of the individual."

Possible Methods of Economising the Available Food Supply.—The Committee suggest various changes which they are satisfied would result in an economy of food without any significant dietetic disadvantage.

Better Recovery of Flour in Milling.—This suggestion has already been adopted in principle by the Food Controller. The Committee estimate that, by raising the percentage of wheat flour milled from 70 to 80, after correcting for loss in digestibility of the flour and the loss of pig meat due to reduction of offals, the net gain for human consumption would be 2·36 grammes of protein and 66 calories per "man" per day.

More Economical Meat Production.—One side of this problem was dealt with in the "Notes on Feeding Stuffs" in this *Journal* for January, 1917, p. 986. By slaughtering cattle when 17 months old in place of the present general practice of slaughtering when 2½ years old, the Committee estimate that there would be added to the food supply 4·17 grammes of protein per "man" per day. "But the universal production of 'baby' beef in place of steer beef is not immediately practicable. It would require much organisation, especially in the care, purchase and distribution of suitable calves, and in many districts would also involve considerable alterations in the system of farming."

A second point in this connection dealt with by the Committee was the need for economy in the winter feeding of oxen, about one-third of the oxen fattened in the United Kingdom during the winter season being overfed to the extent of 2 lb. per head per day of starch equivalent. Again, great economy in fodder would result if the fattening process were discontinued as soon as the weighbridge ceased to show an appreciable increase in live weight.

A third point was that considerable economy in fodder can be effected by varying the kind of animal to which it is fed. All animals are by no means equally good "converters," as is shown by the following figures:—

lb. Starch equivalent in Fodder	required to produce	1,000 Calories in the form of
2·9	..	milk from good cow.
3·0	..	pig meat.
4·7	..	veal.
4·7	..	milk from bad cow.
5·3	..	mutton.
7·0	..	eggs.
7·0	..	"baby" beef.
9·0	..	"steer" beef.

These figures justify the agricultural policy of most Continental countries which rely on dairy products, pig meat and veal for a very large proportion of their supply of animal food.

A given supply of fodder is capable of producing a far greater amount of protein and calories in these forms than if it is used to a very large extent, as in Great Britain, for the production of mutton and beef.

Substitution of Cheese for Butter.—This course has been repeatedly advocated by the Board of Agriculture since the outbreak of war. A brief account of the measures taken to this end will be found in the *Journal* for November, 1916, p. 767.

Assuming that the 2½ million calves of the United Kingdom are to be reared on whole milk (*i.e.*, to allow for the development of "baby" beef production) the Committee estimate that even so, by substituting cheese-making for butter-making, the net gain will be 55,000 tons of protein, or 4·2 grammes per "man" per day; this calculation allows for the difference in feeding value of whey and separated milk.

Prohibition of Brewing.—A complete statement of the case for and against any proposal to divert materials used in brewing to any other purpose, would necessarily have to include a consideration of the cost of production (labour and fuel) in each case. Neglecting these factors and confining the argument to the quantities of food and of energy available for human use, the conclusions arrived at by the Committee may be summarised as follows: The beer, together with the milk obtained indirectly from the by-products of the brewery (*i.e.*, malt culms, brewers' grains and dried yeast) contain between 28 per cent. and 59 per cent. of the energy, and less than 27 per cent. of the protein, of the original materials (*i.e.*, barley, grits and sugar); whereas, if these materials were not brewed, but utilised in the theoretically best possible manner, about 71 per cent. of the energy, and 68 per cent. of the protein would be recovered as human food. This very high recovery is possible only if the use of the barley and other materials as food for live stock is equally prohibited. If, as would otherwise be the case, they were converted into meat, only 15 per cent. of the energy and 17 per cent. of the protein would be realised as human food.

Further, the Committee estimate that the land under hops in 1916 could be made to produce 150,000 tons of potatoes and 300,000 qr. of oats,* equivalent to about 6,600 metric tons of protein and about 230,000 million calories available for human use.

* *Note.—This estimate is evidently a mistake.* The acreage under hops was 31,350, which might have produced 150,000 tons of potatoes *or* say 165,000 qr. of oats if oats could have been grown on the whole area, which they could not be.—*Ed.*

THE COMPOSITION OF ARMY STABLE MANURE.

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IN many parts of the country Army stable manure is being produced in considerable quantity, and is obtainable by farmers who are either near enough to fetch it or are favourably situated in regard to rail or other means of transit.

Several samples of this manure have been analysed at the Rothamsted Experimental Station, with results set out in Table I.

TABLE I.—*Percentage Content of Army Stable Manure in comparison with Farmyard Manure.*

—	Army Stable Manure.				Farmyard Manure, Rothamsted.		
	A From Dumps 8 months old. (Sling).	B Old Dump (Cross Belt).	C New Manure (Bustard).	D New Manure (Colchester).	Farm Stable Manure (Rothamsted).	Cake Fed.	No Cake Fed.
Organic matter	20·7	28·3	22·2	19·6	20·5	—	—
Mineral matter	13·1	24·1	30·8	41·3	4·6	—	—
Moisture	66·2	47·6	47·0	39·1	74·9	72·6	72·8
Total dry matter	33·8	52·4	53·0	60·9	25·1	27·4	27·2
Total nitrogen	0·524	0·563	0·470	0·475	0·442	0·77	0·54
Nitrogen from ammonia	0·105	0·140	0·106	0·126	0·10	0·18	0·04
Potash (K_2O)	0·82	0·94	0·87	0·53	0·73	0·60	0·67
Phosphoric acid (P_2O_5)	0·20	0·33	0·40	0·31	0·24	0·39	0·23

From these figures it is evident that the manure is very good, being at least as rich as ordinary farmyard manure in nitrogen, though it falls behind good cake-fed manure. As is well known, stable manure is the mixture of fæces and litter, and its composition therefore depends on the food of the animal, the use it is making of the food, and the material used for litter. The Army horses are well fed, so that the excreta are rich. Unfortunately, from the farmer's point of view, the stalls are not designed primarily for the making of manure, and consequently most of the urine is lost; the stable manure contains only the solid excreta and not the liquid; it is not, therefore, as rich as bullock manure, made on an equally liberal diet, where the urine is saved. Another circumstance is that the Army manure contains very little litter. Straw is used in some places and peat in others. Speaking generally, however, the method of stabling

and collection is such that the solid excreta constitute the larger portion of the manure.

This is shown in the relative dryness of the Army manure. Ordinary farmyard manure, even when made under cover, contains about 70-75 per cent. of water. One of the samples of Army horse manure contained less than 40 per cent., two contained less than 50 per cent., and the fourth contained 66 per cent. There is, however, a large proportion of mineral matter in Army manure, much of which is sand or grit which has been swept up, and is of no fertilising value. This rose to 41 per cent. in one sample, the other figures being 13, 24, and 31 per cent., respectively; ordinary farmyard manure contains about 5 per cent. As a rule, what the Army manure gains in dryness it loses in possessing so much sand and grit, so that the amount of organic matter—the real fertilising material—is much the same as in ordinary farmyard manure. Consequently, the nitrogen, phosphoric acid, and potash are not very different in amount from the usual figures; the ammoniacal nitrogen is lower than might be expected from the food, because the urine, which is fairly rich in ammonia, largely runs to waste.

TABLE II.—*Composition of Army Stable Manure expressed in lb. per ton.*

—	Army Stable Manure.				Farmyard Manure, Rothamsted.		
	A From *dumps* 8 months old (*Sling*).	B Old Dump (Cross Belt).	C New Manure (Bustard).	D New Manure (Colchester).	Farm Stable Manure. (Rothamsted).	Cake Fed.	No Cake Fed.
Organic matter ..	464	634	497	439	459	—	—
Mineral matter ..	293	540	690	925	103	—	—*
Moisture ..	1,483	1,066	1,053	876	1,678	1,626	1,630
Total dry matter	757	1,174	1,187	1,364	562	614	609
Total nitrogen ..	11·7	12·6	10·5	10·6	9·9	17·2	12·1
Nitrogen from ammonia.	2·4	3·1	2·4	2·8	2·2	4·03	0·9
Potash (K_2O) ..	18·4	21	19·5	11·9	16·4	13·4	15
Phosphoric acid (P_2O_5) ..	4·5	7·4	9	6·9	5·4	8·7	5·2

Table II. gives the results of the analyses translated into lb. per ton. From this it appears that one ton of Army stable manure contains 18 lb. of potash, or as much as is present in 144 lb. of kainit, and a dressing of 12 tons contains as much as 15½ cwt. of kainit, or 3½ cwt. of sulphate of potash. Thus, even apart from its organic matter and its nitrogen—both highly valuable substances—the Army manure is specially valuable as a source of potash.

The condition of the manure is all that could be desired. Little, if any, straw is present, and there is not much peat moss, so that there is nothing to open up the ground and "let in the draught" on light soils. Instead, the manure is in a finely divided state in which it can easily decompose in the soil.

Some of the dumps are old, and some are recent. There is, however, less difference between old and new samples than might be expected from analogy with farmyard manure. In the first place, the Army horse manure does not contain so high a proportion of ammonia as good farmyard manure, and, therefore, it cannot suffer so great a loss on storage. The main difference however, is in the nitrogen content. Horse manure exposed to air loses less nitrogen than farmyard manure. Various factors appear to be at work, one of the most interesting being the possibility of the actual fixation of nitrogen, which has recently been demonstrated by Mr. E. H. Richards in the Rothamsted laboratories. A further reason for the low loss of nitrogen is the circumstance that the dumps are made as compact as possible by running the carts over them. This is done with the double purpose of checking the breeding of flies, which otherwise would become a pestilential nuisance, and of economising space by getting as much manure as possible on to one dump.

From these remarks it is obvious that farmers ought by every means in their power to secure as much of this Army horse manure as possible. In some camps it is offered at 1*s.* per load, which on the type of carts used is about 15–18 cwt.; the price per ton is, therefore, about 1*s.* 1½*d.* to 1*s.* 4*d.* No other available fertiliser can compare with this, and in the wet spells, when horses cannot work on the land, farmers will be well advised to haul some of this manure by road, if they can possibly get it.

At other camps the price is higher; in one place it is 2*s.* 6*d.*, but, even so, the manure is cheap. When railway charges have to be added the cost may become considerable. The manure is worth at least 5*s.* per ton on the farm.

In view of the high value of the manure it is a very great convenience to farmers when the dump can be made in some spot that is easily accessible by road, rail, or barge; and it would be an even greater advantage if some help could be given in the cartage—not financial help, but the supply of horses and men. This is likely to be the chief difficulty, and an effort ought to be made to overcome it. Inquiries as to Army manure should be addressed to the Officer Commanding, Army Service Corps, at the nearest camp.

VARIETIES OF OATS AND BARLEY:

AN ACCOUNT OF THE RESULTS OF SOME RECENT EXPERIMENTS IN ENGLAND AND WALES.

THE growing of the largest possible crops of oats and barley takes an important place in any scheme concerned with the supply of food during the present year. While the home production of oats has so far been well maintained during the War, that of barley has dropped by 1,600,000 qr. since 1913; the imports of oats and barley last year were each only two-thirds of the quantities recorded in 1913, and, since the world crops of these cereals in 1916 were deficient, there is not much prospect of improved supplies from abroad until after the present year's harvest.

The President of the Board has suggested to farmers that it is better to depend on oats and barley where lateness of season or any other cause is likely to operate against full crops of spring wheat.

The oat and barley crops have become more than ordinarily important by reason of the Manufacture of Flour and Bread Order, which allows a considerable proportion of the 280-lb. sack of flour for bread purposes to consist of flour ground from oats and barley.* This concession in the case of barley is a counterpart to the curtailment in the supplies of malting barley required for brewing purposes, the output of beer after 1st April next being reduced to 70 per cent. of that of 1915, and to about 50 per cent. of the quantity previous to the outbreak of war.

The value of barley and oats to the country has been further enhanced by the scarcity of animal feeding stuffs—either imported or manufactured from imported materials. The part transference of barley from beer-making to bread-making will also help the position as regards feeding stuffs. Under the Food Control Orders about 40 per cent. of the barley used in bread-making will be returned in the shape of millers' offals as compared with the 25 per cent. returned by the brewer in the form of brewers' grains.

Oats derive additional importance from the point of view of home food production because of their suitability for ploughed-up grass land. The Army Council has offered to contract

* The prescribed percentage of flour required to be milled from wheat is 76 on the average. Beyond this, five points are compulsory, and may be obtained either by milling the wheat to a higher percentage or by adding flour ground from rice, barley, maize or oats. In addition, the miller has an option to add a further five points obtained in the same way (see p. 1150).

with farmers for oats grown on ploughed-up grass land in 1917 at 41s. 3*d*. per qr. of 320 lb., provided that suitable artificial manures to the minimum value of 25*s*. per acre are applied. The price fixed by the Food Controller for the 1917 crop of oats is 38*s*. 6*d*. per qr. of 336 lb. There is thus a bonus of 4*s*. 7*d*. per qr. of 320 lb. on oats grown in 1917 on ploughed-up grass land.*

The following notes on variety experiments with barley and oats according to the districts in which the trials were made, may be of value to farmers in those districts in deciding on varieties for the current year. Further information as to varieties suited to particular districts may be obtained on application to the local county organiser or the provincial college.

VARIETIES OF OATS.

[*The figures in brackets indicate the references given on p.* 1063].

North of England.—The experiments with varieties of oats at Cockle Park (1) here referred to were carried out in 1913 and 1914 on a poor, clay loam soil (different fields) after three years' ley, and in 1915 on a sandy loam soil after one year's ley. The oats were top-dressed with 1 cwt. per acre of nitrate of soda in 1915. In all three years the residual nitrogen of wild white clover had most valuable effects. The following were the results in the three years:—

Variety and Origin.	*1913. Clay Loam.* Grain. bush. (42 lb.)	Straw. cwt.	*1914. Clay Loam.* Grain. bush.	Straw. cwt.	*1915. Sandy Loam.* Grain. bush.	Straw. cwt.
Great Mogul (Black), Svalöf, 1912	78¾	37½	79	39¾	93⅓	44
Black Bell II., Svalöf, 1911	74½	30⅓	73	38½	84	40¾
Blainslie, Chathill, 1911	74¼	40	59	44	70½	43½
Sensation, Canada, 1913	59¾	31¼	65	36⅓	83	37
Banner, Canada, 1910	35	19¼	77⅓	41	87	39
Banner, Ottawa, 1913	78⅓	35½	76½	42½	92	40¾
Banner, Canada, 1914	—	—	71½	42½	95½	42
Mammoth White Cluster, Canada, 1914	—	—	70	37½	96	40¼
Canadian Western, Canada, 1914	—	—	65½	37¾	97⅓	42
Victory, Svalöf, 1911	37¾	17½	67	39¾	98	43
Victory, Svalöf, 1914	—	—	62½	38	90	46
Original Crown, Svalöf, 1913	67	26¾	68¾	37	98	37
Yielder, Hepscott, 1915	—	—	—	—	87½	32¼

At Cockle Park, oats from Canada have given remarkably good results; among these, Banner, Sensation, Thousand Dollar, have all done well. Trials carried out in earlier years with strong-strawed oats like Storm King did not give good results, and so were discontinued. Fine-strawed oats, like Blainslie and Tam Finlay, have given excellent straw for fodder, and on a cold, clay soil, in a bad season, have grown better than other varieties. Their grain is small, however, and, as a rule, they are considerably behind the others as grain-producing oats.

The seed rate has varied from about 3½ bush. in the case of Blainslie to about 5 bush. in the case of big-grained oats such as Leader and Yielder; the seed is usually sown at the beginning of April.

Yorkshire.—As a result of experiments carried on between 1901 and 1907, Leeds University (2) reported Storm King, Tartar King, Waverley

* Further particulars as to oat prices and bonus will be found on p. 1133.

and Abundance as the best white oats, and Excelsior as the best black oat. For land in high condition, where there is risk of over-luxuriance, Tartar King and Storm King (stiff-strawed varieties) were recommended, and Abundance and Waverley on less fertile land.

New varieties have been tried since that date. The following results have been obtained between 1912 and 1915. The seed was usually drilled during the first or second week in April, at the rate of 4 bush. per acre (3) :—

Variety and Origin.	*Yield of Saleable Grain.* 1912. bush.	1913. bush.	1914. bush.	1915. bush.
Abundance	36¾	49	32	35¾
Yielder	45¾	50	53¼	—
Record	34¾	50¼	53¼	44¼
Leader	—	—	55¾	43¼
Storm King	33	—	—	—
Tartar King	36¾	46	55¾	—
Beseler's Prolific (Scotland)	23	49	29½	39¼
Victory (Svalöf)	—	49¾	51¼	35
Golden Rain (Svalöf)	—	43¾	44½	22½
Crown (Svalöf)	—	—	46¼	37¾

Lancashire.—The following table shows the results obtained in trials in Lancashire (4) between 1911 and 1913. The oat crop in most cases followed first or second year's ley. On one or two farms a light dressing of nitrate of soda was given as a top dressing, but in the majority of cases no manure was applied :—

	1911 (3 centres). Good. bush.	Seconds. bush.	*1912 (2 centres).* Good. bush.	Seconds. bush.	*1913 (5 centres).* Good. bush.	Seconds. bush.
Abundance	33	2	36	3	47	3
Banner	49	6	42	6	64	7
Goldfinder	58	4	34	6	62	6
Propsteier	55	2	41	3	68	3
Victory	62	3	42	5	71	4
Wide Awake	57	4	40	5	59	7

The excellent results obtained in all three years with the Svalöf varieties (Propsteier and Victory) will be noticed.

Shropshire and Stafford.—Oats were tested by Harper Adams Agricultural College on a heavy loam in 1913 and a sandy loam in 1914. The seed rate was 4¼ bush. The following were the yields per acre for varieties tested in both years (5) :—

Variety.	*Grain.* 1914. bush. (39 lb.)	1913. bush. (39 lb.)	*Straw.* 1914. cwt.	1913. cwt.
King's New White Oat	88¼	89	38	46
Abundance I.	84¾	90	35½	43
Victory	85½	74	40½	41
Thousand Dollar	84	95	33¼	28
Abundance (New Zealand)	84½	86	34½	33
White Horse	61¾	69	26	30

Midland Counties.—The following yields per acre (in bush. of 42 lb.) were obtained with varieties grown by the Midland Agricultural and Dairy College in 1911 and previous years (6) :—

Variety.	*1911* (4 *centres*).	*1910* (5 *centres*).	*1909* (5 *centres*).	*1908* (6 *centres*).
White Horse	66·0	47·3	54·6	—
Triumph	63·6	49·2	—	—
Thousand Dollar	61·3	45·0	53·6	75·5
Propsteier	60·6	48·6	54·3	74·8
Abundance	57·8	50·2	53·6	67·0

It was recommended that as regards yield, *White Horse* should be preferred for dry, firm soils, free from excess of moisture; this variety always compared best with the others in a dry season such as that of 1911. The yield was good, but, compared with ***Abundance***, which it resembles generally, the straw and grain were slightly coarser and the grain was of a deeper colour.

Triumph, a French variety, justified its inclusion in these trials. It was not nearly so luxuriant as Abundance and it ripened later; its grain is of fair average quality.

Thousand Dollar, an American variety of the Abundance type, was plump and of good quality. It was one of the first to ripen.

Propsteier, owing to its strength of straw, should be preferred to Triumph and Abundance on fen land, or on soils when the crop is likely to be laid; where the crops were laid it was the last to go down and then did not lie so close to the ground as the other varieties tested. In most cases Propsteier was the last to ripen, and was very luxuriant in growth.

Essex.—Five varieties of oats have been tried for three years at four centres each year. In each year each variety took the same position, which was as follows:—

Variety.	*Grain.* bush. (average).	*Variety.*	*Grain.* bush. (average).
Leader	65	Victory	53
Golden Rain	56	Beseler's Prolific	51
Abundance	55		

North Wales.—Two sets of experiments may be referred to. The first was carried out at the Madryn Farm on a thin, medium loam between 1903 and 1909. The results in bushels per acre were as follows, the number of years tested being shown in brackets. The oats were sown in April:—

Variety.		*bush. per acre.*	*Variety.*		*bush. per acre.*
Schlandstedter	(3)	95	Newmarket	(7)	72
Daubeney	(3)	93	Abundance	(7)	71
Anderbecker	(3)	89	Universal	(3)	69
Siberian	(3)	86	Goldfinder	(7)	68
Rival	(4)	81	Black Tartarian	(7)	66
Wideawake	(6)	80	Excelsior	(7)	63
White Horse	(3)	77	Colonel	(4)	60
Storm King	(6)	75	Storm King	(7)	60
Banner	(7)	73	Pioneer	(3)	50
Waverley	(7)	73			

In 1914 and 1915, trials were carried out by the Bangor College on a poor, heavy loam, previously under grass for a considerable number of years, with the following average results for the two years, per acre (8):—

Variety.	*Grain.* bush.	*Straw.* cwt.
White Oats:		
Abundance	70½	46
Crown	71¼	51
Leader	78	44
Record	85	49
Victory	81	47
White Cluster	77½	49
Yellow Oats:		
Golden Rain	65	47
Goldfinder	76½	46
Black Oats:		
Black Mogul	89	61
Black Tartarian	67	51
Bountiful	74	48
Supreme	72	30

The following notes relate to the value of these varieties for North Wales:—

On ground in really good condition in the wet climate of North Wales a stronger strawed variety than *Abundance* should be sown; under suitable conditions this variety has remarkably high quality grain and straw, and is about average as regards quickness of growth and earliness of ripening.

The Svalöf variety *Crown* has no special value for North Wales except for the weight and stiffness of its straw. It made a vigorous growth and ripened late.

The early ripening of *Leader* is of importance in the late districts of North Wales. It gave a satisfactory yield of grain and stood up well.

Record is recommended for land in high condition, particularly in the wet climate of the western districts of North Wales. For a strong-strawed variety it gave a distinctly good quality of grain.

Victory (Svalöf) had the serious defect of weakness of straw, but is recommended on ground that suits the Abundance type of oat.

Golden Rain (Svalöf) ripened early, gave fairly strong straw, and is recommended for trial where an early ripening yellow oat is required. It has no advantage, except earliness of ripening, over *Goldfinder*, which gave satisfactory yield and strong straw.

Black Tartarian has special value for poor conditions because of its hardiness, strong straw and early ripening. It is not so suited for good lowland conditions.

Bountiful gave good results in these North Wales trials; it is very early, has exceptionally long straw, stands up well, and gives grain of excellent colour.

White Cluster is similar to Potato oat. It did not compare favourably with the other white varieties tried as regards yield of grain, and the straw was weak, but of good feeding quality.

Black Mogul (Svalöf) proved a heavy cropper of grain and straw, but the latter was weak.

VARIETIES OF BARLEY.

North of England.—Barley is usually sown at Cockle Park at about the end of March or beginning of April, at the rate of 3½ to 4 bush. per acre.

The varieties of barley given in the table below have been tested for a number of years, the averages given being those for the last seven years. During this time a clay-loam soil has been used in four years,

and a sandy loam in three years. The barley crop was in each case taken after swedes (1):—

Variety and Source.	*Average Yield in 7 years.* *Grain.* bush. (56 lb.)	*Straw.* cwt.
Archer (East Lothian, 1909)	45¾	33
Chevalier (Cockle Park since 1903)	42	35
Hannchen (Svalöf, 1911)	41*	31¾*
Primus (Svalöf, 1911)	35¾*	28¾*
Goldthorpe (Cockle Park since 1903)	40¾	29½
Maltster (Garton's, 1910)	42¼	33¼

* Average of five years.

Primus and *Maltster* are of the Goldthorpe type, with short, broad ears, while *Archer* and *Hannchen* are of the Chevalier type, with long, narrow ears. The former usually ripen a week or ten days earlier than the latter.

In the 13 years that they have been grown at Cockle Park *Chevalier* has averaged 43 bush. of grain and 30½ cwt. straw, while *Goldthorpe* has averaged 42½ bush. grain and 29 cwt. straw. The latter has always been valued higher than Chevalier for malting purposes, being better ripened and having a better-filled grain, probably due to its early maturity and its smaller liability to become lodged or laid. In good barley years Goldthorpe is the larger grain producer.

Yorkshire.—In trials at Garforth (2) from 1901-7, *Brewer's Favourite, Goldthorpe, Standwell* and *Chevalier* did best, and these varieties have also done well in more recent years. It is recommended that on land in good condition *Chevalier* and *Standwell* should be avoided and *Brewer's Favourite* or *Goldthorpe* grown, but where barley is taken as the second corn crop these considerations are not of such importance.

Shropshire and Stafford.—In the Harper Adams College experiments barley was drilled at the beginning of April on a heavy loam in 1914, and on a sandy loam in 1913, with the following yields per acre (5):—

Variety.	*Grain.* *1914.* bush.	*1913.* (56 lb.).	*Straw.* *1914.* cwt.	*1913.* cwt.
Gold (Svalöf)	59	—	26¾	—
Princess (Archer)	56	46	35¾	19
Maltster	53	34½	27¼	16
Archer's Stiff Straw	52¼	41¾	35	16
Goldthorpe	50	38¾	28¾	16
Burton Malting	49½	47½	31½	21
Plumage	49¼	37	34	18
Standwell	48½	45½	35¾	22
Hannchen (Svalöf)	45½	—	33½	—
Swan Neck (Svalöf)	38¾	—	23	—
Primus	38¼	33½	21	16

Midland Counties.—Experiments carried out at the Midland College up to 1907-8 led to the conclusions that *Archer's Chevalier* may fairly lay claim to being one of the heaviest yielding varieties that the farmer has at his disposal; that, as a whole, the *Chevaliers* are somewhat weak-strawed and susceptible to lodging, and that Archer's Chevalier is one showing the least tendency to this fault.

Early sowing and plenty of sun were found absolutely essential to the satisfactory development of *Hanna* (Austria). It is, in consequence, best suited to the light, warm class of soils.

These trials point strongly to the fact that Chevaliers, more especially Archer's Chevalier, are capable of producing the heaviest yield of grain, but such grain is on some soils and in dull seasons not of *the best quality. They also show that barleys of the Goldthorpe type* generally produce in Lindsey better samples of grain than the Chevaliers.

East Suffolk.—Experiments in 1914 gave the following results (bushels per acre) (9) :—*Beaven's Archer*, 42½; *Irish Archer*, 42½; *Princess Archer*, 42¼; *Plumage Archer*, 41½; *Chilian Chevalier*, 37; *Irish Goldthorpe*, 37; *Kinver Chevalier*, 36½. The 1913 experiments agreed in showing the superiority, in value per acre, of the pure *Archer* types over *Chevalier*.

Goldthorpe does not seem to do well in Suffolk. "Barley growers in Suffolk would be well advised to grow one of the three pure strains of *Archer*, the seed of which is now obtainable without any difficulty in all parts of Suffolk."

Essex.—Barley is usually sown at the end of March at the rate of three bushels per acre. In an experiment in 1912, however, it was *sown as late as 10th April with good results.*

The three years' averages in the Chelmsford experiments, 1911–13, were as follows, in bushels of saleable grain (56 lb.) per acre :—*Archer*, 48½; *Plumage Archer*, 46½; *Plumage*, 43½; *Chevalier*, 41; *Maltster*, 40. The varieties took the same order whether they were grown on (*a*) light loam on chalk subsoil, or (*b*) chalky, boulder clay (7). *Plumage Archer, Maltster*, and *Plumage* were found to be much superior in standing power to the other two varieties.

The following are the notes given on the varieties (7) :—

Archer.—Narrow-eared variety, somewhat coarser in grain and later in ripening than Chevalier. It has little or no "neck," the leaf sheath extending almost up the lowest grains of the ear, a characteristic which serves to strengthen the straw and render it little liable to "necking." *It seems fairly well established that on the various soils of Essex and* Herts, *Archer* is a variety which can be relied on to give a good crop. The seed used was from a pure line carefully selected by Mr. E. S. Beaven.

Plumage.—Broad-eared or Goldthorpe type. Grain of remarkably *fine quality, but straw only moderately stiff.* Has a long "neck" like all Goldthorpes, somewhat liable to break off at harvest. One of the best croppers of Goldthorpe varieties.

Plumage Archer.—Cross between Plumage and Archer. Possesses the cropping power of Archer and the quality of Plumage. Standing power greater than that of either Plumage or Archer. Like Archer, it has a short "neck," and does not suffer from "necking." Ripens later than Plumage, resembling Archer in this respect.

Chevalier.—Grain, if well harvested, is generally of good quality, and highly suitable for malting purposes. Unfortunately, however, fine quality of grain being usually accompanied by weakness of straw, this variety is comparatively easily laid, and its value is, consequently, liable to be impaired.

Maltster.—Broad-eared type raised by Gartons. Grain is a little coarser than that of Plumage. Possesses stiff straw, ripens moderately early, and is especially recommended for growing on a rich soil where lodging is feared.

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(1) Cockle Park. Guide to Experiments, 1916.
(2) Leeds University Agric. Dept. Bulletin 71.
(3) Leeds University Agric. Dept. Guides to Experiments, various.
(4) Lancashire County Council. Farmers' Bulletin 26.
(5) Harper Adams Agricultural College. Report on Field Experiments, 1914.
(6) Midland Agricultural and Dairy College. Report, 1911–12.
(7) East Anglian Institute of Agriculture. Report on Experiments, 1914.
(8) University College of North Wales. Bulletin II., 1915.
(9) East Suffolk County Council Educ. Com. Circular 15, 1915.

OBSERVATIONS ON SILAGE,
WITH A SHORT DESCRIPTION OF VARIOUS TYPES OF SILOS RECENTLY ERECTED IN EAST ANGLIA.

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As previously noted in this *Journal** there has recently been a revival of interest in the practice of ensilage, particularly in East Anglia. In view of the interest taken in the subject a short description of the various types of silos erected may be useful to British farmers.

Various Methods of Making Silage.—Before describing the silos erected a short account of some methods of making silage, without the use of a silo, which the writer has had an opportunity of investigating, may not be out of place.

He has seen sweet silage successfully manufactured from grass, in clamp-like heaps, the whole being covered, like a manure heap, with soil, which constituted the only permanent weight applied.† At the time of erection however, the heap was usually consolidated by carting over it with the carts, as is frequently done in the case of manure heaps. This method of manufacture, as far as the observations of the writer go, resulted in a sweet silage, with a pleasant smell, the whole somewhat resembling tobacco in appearance. The advantage of the method lies in the fact that no special apparatus is necessary, and the principal disadvantage is the very considerable waste which takes place on the sides, top, and bottom of the heap.

The writer has seen this method applied very successfully—chiefly in Ireland—to unchaffed grass, but has never seen it

* *Silage Made from Oats and Tares as a Food for Milking-Cows*, A. W. Oldershaw, *Journal*, June, 1916, p. 224, and *A Preliminary Enquiry into the Cost of Production of Silage in East Anglia*, A. Amos and A. W. Oldershaw, *Journal*, July, 1916, p. 333.

† *Sweet Stack Silage*, T. Wibberley, *Journal*, September, 1916, p. 581.

tried with clover or vetches. In one case investigated in Nottinghamshire, about 5 acres of spring-sown wheat, which failed to ripen, were cut green, the crop being placed in its long state in a heap of this type. This resulted in excellent material in the middle of the heap, but a thickness of quite 2 ft. on the sides and top of the heap was spoilt by mould. Evidently in this case the open nature of the wheat straw permitted too much air to get into the heap.

The manufacture of silage in gravel pits or similar holes has been under observation on two farms in Suffolk. In these cases the sides and opening of the gravel pit have been roughly supported with wood, a chaff-cutter has been fixed on a side of the pit, and the pit then filled—in the cases under observation to a depth of about 15 ft.—with chaffed green material.

The green stuff was then covered with rough ditch trimmings (*e.g.*, nettles, etc.), then with soil, and finally weighted down with heavy logs of wood, or with planks and heavy flags or stones. This has resulted in quite good silage of a moderately sour type; but there has been very considerable waste at the sides and entrance of the pit. This method of manufacture is worthy of note, as it provides a means by which a farmer can preserve bulky green stuff, which, owing to an exceptionally luxuriant season, has exceeded the immediate requirements of his stock.

Both this method and the clamp method of ensilage may be adopted by any farmer in adverse seasons, even if he has no intention of adopting ensilage as part of his regular farming practice.

Modern Methods of Making Silage.—As the general principles of modern silage practice may not be familiar to farmers in all parts of the country, it may be stated that the silage crop (usually winter oats and tares) is chaffed and then transferred to the silo. In East Anglia the method adopted has been to use a combined chaffer and blower or elevator, by which the chaffed material is blown up a long tube about 1 ft. in diameter, to the top of the silo, whence it falls down—preferably through another tube—to the feet of the man inside, who tramples round the edge to keep the material solid. In filling the silo the outer edge cannot be trampled too much; the middle requires much less trampling. A movable tube inside the silo is an advantage, as it enables the man to guide the chaffed material to any desired spot. There is no very obvious reason

why other means of elevating the silage material should not be adopted if such were available.

The silage is removed from the silo by means of doors which are placed at convenient intervals in the walls. A chute is often provided to guide the silage into the cart below, but this is not absolutely necessary, as old bags can easily be used for this purpose.

The chaffer and blower used by most East Anglian farmers is of American make, there being apparently no suitable machine of English make on the market. In one case this machine is also used for chaffing oat straw for fodder and wheat straw for litter, the blower being used to blow the chaff wherever it is wanted.

Most Suitable Crops.—As far as is at present known, the most suitable crop for silage, under English conditions, appears to be a mixture of winter oats and tares. Lucerne also makes excellent silage. Rye, when mixed with tares, is apt to get too forward and to make rather woody silage. Grass or clover may be used quite well, but the weight of green grass, or even of clover obtained will not often exceed 8 tons per acre whereas 14 tons of oats and tares may easily be grown on useful land.

Figures illustrating the weights of green material likely to be obtained were given in the issue of this *Journal* for July 1916, p. 335.

The following further figures have been obtained during the past year, each result being the average of two or more weighings :—

	Weight of Green Material per acre. tons.	cwt.
Field 1.—*Light land.*—Spring-sown tares and oats, manured with farmyard manure ..	13	10
,, 2.—*Medium loam.*—Winter tares and oats, no manure	14	0
,, 3.—Plot 1.—*Poor, heavy land.*—Winter rye and tares, no manure	7	5
,, 3.—Plot 2.—*Poor, heavy land.*—Winter tares alone, no manure	11	15

In the case of Field 3 the plots weighed were within a few yards of each other. The figures obtained seem to indicate that on poor, heavy land at any rate, the inclusion of rye is likely to diminish considerably the weight of green material obtained No opportunity has occured of ascertaining whether the dry

matter obtained per acre from such land is also likely to be diminished by the inclusion of rye. In most parts of England 2 tons of meadow hay and 3 tons of clover hay will be regarded as good crops. It would appear from investigations conducted by the writer that 1 ton of hay usually represents from 2½ to 3 tons of green material cut when free from dew. The heavy crop of 3 tons of clover hay per acre would on this basis represent only 9 tons of green material.

Of the crops mentioned above, therefore, it would appear likely that none will often equal oats and tares in weight of green material given by the first crop except, possibly, tares alone. Lucerne possesses the great advantage of yielding heavy crops of green stuff on poor land over a period of 5 or 6 years at very little expense either for labour or seed. The writer has no experience of silage made from sainfoin.

Silage Made from Mixtures of Various Materials.—An opportunity occurred of observing the results obtained, on farms near Beccles, Suffolk, from mixing together chaffed green mustard and tares with chaffed dry oat straw. This was quite a successful mixture, and produced good silage. Good results have also been obtained on the same farms by making silage of a mixture of chaffed green stuff and damaged dry hay.

It, therefore, appears probable that the principle of mixing chaffed dry straw or hay with materials which are very moist is a sound one. As previously noted in this *Journal*,* the manufacture of silage from maize has not hitherto been very successful in this country, owing apparently to the very watery character of maize grown here. Whether this defect can be overcome by the introduction of early-maturing varieties (*e.g.*, the Squaw or Early Compton) or by mixing the maize with chaffed dry material, such as pea, bean, or oat straw, or damaged hay, is a matter for further investigation.

In October last the writer was present when a silo on a farm occupied by Mr. Fred Smith, of Woodbridge, was being filled with green maize. A considerable quantity of juice was oozing from the bottom of the silo. It is evident from this that a rather substantial waste of nutrient material was going on. It appears highly probable that this waste could be largely prevented by including a proportion of chaffed dry material with the maize. The writer is informed that Mr. Fred Smith made silage from maize in 1915, the resulting silage being quite satisfactory.

* July, 1916, pp. 333 and 334.

Composition of Silage Made by Modern Methods.—In addition to the analysis of silage quoted in an earlier number of this *Journal**, the following analyses of silage manufactured under modern conditions are available, having been made by Mr. G. S. Robertson, M.Sc., and published by his permission:—

Nature of Green Crops.	(1) *Oats and Tares.*	(2) *Oats and Tares.*	(3) *Mustard, Tares, and Chopped Oat Straw.*	(4) *Tares, Oats, Rye, and a little Wheat.*	(5) *Maize.*
Moisture	67·44	72·30	77·93	69·43	84·85
Oil	1·15	1·14	0·97	0·84	0·57
Albuminoids	3·84	4·96	3·09	3·17	2·19
Soluble Carbohydrates	15·21	9·75	6·47	11·05	6·31
Fibre	10·60	9·43	9·02	13·29	4·48
Ash	1·76	2·42	2·52	2·22	1·60
	100·00	100·00	100·00	100·00	100·00
Food Units	26·69	23·78	15·9	20·27	12·66

(1) Made in a cylindrical silo on the Somersham farm of Mr. H. Fiske, Bramford, Ipswich.
(2) Made in a cylindrical silo on the Blofield Hall farm of Mr. C. C. Smith, Walton Hall, Felixstowe.
(3) Made in a gravel pit on the Ringsfield farm of Mr. F. W. D. Robinson, Roos Hall, Beccles.
(4) Made in a cylindrical silo on the home farm of Mr. F. W. D. Robinson, Roos Hall, Beccles.
(When filling this silo the weather was exceptionally wet, but the work went on as long as it allowed the men to work out of doors.)
(5) Made in a cylindrical silo on the farm of Mr. Fred Smith, Woodbridge.

The difference in composition of the above samples is undoubtedly chiefly due to the difference in the materials with which the silos were filled.

Various Types of Silos.—*Reinforced Concrete Silos.*—The writer is acquainted with six silos built of reinforced concrete. These have been built on the general lines advocated by Mr. Digby Hussey de Burgh, Drumkeen, Pallas Green, County Limerick.

(1) As far as the writer is aware, the first concrete silo to be built in East Suffolk was erected on the home farm of Mr. F. W. D. Robinson, Roos Hall, Beccles. This silo is cylindrical in shape, of 25 ft. internal diameter and 36 ft. high; the walls are 1 ft. thick. It was filled for the first time in 1915, having been built a few months previously.

A cubic foot of silage taken out of the centre of this silo weighed 56 lb. After filling with chaffed oats, tares and rye, and settling, the silage reached a height of 30 ft., so that on this basis the silo would hold 368 tons. A silo of this size should be built only when a very large head of stock is kept.

* *Silage as a Food for Stock*, G. Jaques, March, 1916, p. 1249.

Mr. Robinson now considers that the inclusion of rye in the silage mixture is a mistake, and a perusal of the analysis on p. 1067 would confirm this view. From the experience gained at Roos Hall it would appear that the chaffed material must be thoroughly trampled, especially round the outer edge of the silo, and there is then, in all concrete silos inspected by the writer, practically no damaged material.

When the silo was nearly full, nettles and other rubbish were put on the top to a depth of 3 ft., and this prevented loss of good material, which would undoubtedly have occurred otherwise. The silo was filled quite full, and when settled there were 30 ft. of good silage, 1 ft. of nettles, and 5 ft. of empty space.

Mr. Robinson's silo was erected by a local builder, the carting of material, etc., being done by the farm staff.

In the erection of the walls, a circular mould about 2 ft. deep was used, and each ring of concrete was 18 in. deep. During the process of erection barbed wire wound round iron standards, old boiler tubes, etc., were embedded in the concrete.

There are one large and three smaller doorways in the side of the building. The large one is level with the ground and large enough to allow of empty carts being backed in. The small ones are large enough to admit the body of a man, and are situated like windows, above each other, at intervals. The floor of the silo is level with the ground outside. Iron ladders are inserted on the outside in the concrete, as in the case of Mr. Oldrin's silo described below.

It was not originally intended to put a roof on the silo, but afterwards it was decided to do so. The roof has a door in it to admit the tube of the blower. The roof cost £35.

No exact record was kept of the cost of the building, but it is probable that a similar silo could be erected in normal times by a farmer for £150, or £180 with roof, the farmer to find his own sand, grit, etc.

On most farms the work of collecting sharp sand, grit, etc., can be done at slack times, and does not cost the farmer so much as if he did the carting by contract.

(2) A silo was erected during the summer of 1915 on the farm of Mr. John Oldrin, Rushmere, Lowestoft. It is cylindrical in shape, of 15 ft. internal diameter, and its height is 25 ft., of which 5 ft. are below ground. Mr. Oldrin would have preferred it higher, as there is proportionately less waste in the higher silos. The concrete walls are 1 ft. thick and on the floor there is 1 ft. thickness of concrete. The walls were

strengthened with old sheep netting, barbed wire, and old iron embedded in the concrete, while they were also cemented on both sides.

The material used included 50 loads of gravel, 10 loads of sand, and 11 tons of cement.

A circular mould for fixing the concrete in its place was made by a local carpenter, creosoted wood being used. Its depth is 2 ft. 9 in., so that, allowing for a piece lapping over old work, concrete to a depth of 1 ft. 10 in. was fixed in place in a day. The cost of the mould was £7 10s., but it can be used for a large number of silos.

Each of four wooden doors is fitted in a ledge, and kept in position by the inside pressure of the silage; as soon as the silage is taken out the door falls inwards. The doorways are situated one above the other like windows, and serve for the removal of the silage. Short, iron ladders were inserted below each doorway on the outside of the silo, the ladders being fixed in the concrete by iron bars, inserted at the time of building. Over each door space is placed a hanging iron ladder, attached to the lowest rung of the iron ladder immediately above it. This serves to allow men to climb to the doorways above; it is removed when the door is taken out.

Rings were inserted in the concrete on one side of the silo, to support the tube of the blower.

The work was done by a local bricklayer, assisted by four labourers. No exact account was kept of the cost, which was, however, lower than would have been the case under normal circumstances, owing to the fact that Mr. Oldrin secured his gravel at a specially low price.

(3) A silo on the farm of Mr. S. Balls, Carlton Colville Hall, Lowestoft, is cylindrical in shape, of 15 ft. internal diameter, 25 ft. high above ground, and sunk 5 ft. below ground.

The material used included 45 loads of gravel, costing 2s. a load; 10 loads of sharp sand, costing 2s. a load; and 12 tons of cement.

The silo is similar in type to Mr. Oldrin's, except that there is a wooden staircase instead of an iron one, and that a wooden chute is arranged over the doors to guide the silage into a cart which can be backed up below, this preventing trouble from the wind blowing the chaffed silage at the time of emptying. There are fire doors in the silo, the openings being 2 ft. 6 in. by 3 ft.

The concrete walls, 1 ft. thick, were reinforced with old iron, an old stack bottom and a disused drag-rake being broken

up for the purpose. About 2 cwt. of old barbed wire was also used. The silo is washed inside and out with cement. An exact account of the cost of building and materials was kept, and amounted to £112, not including the cost of carting gravel, which was done by Mr. Ball's own men when the land was wet, or in slack times. If the carting had been done by a contractor, the cost of the silo would have been about £120.

(4) A silo on the farm of Miss M. Gillett, Walpole, Halesworth, is very similar to (3) above. It is of 15 ft. inside diameter, and the total height is 30 ft., of which 4 ft. are below ground. The roof is of galvanised iron; the wooden ladder has movable steps opposite each door, and there is a wooden chute which is bolted into the concrete.

As regards cost of building, 12 tons of cement were used, costing £27 5*s.* 2*d.*; old iron cost £1, and the builders' bill was £66 5*s.* 8*d.*, including roof, chute and all materials except concrete; this is a total expenditure of £94 10*s.* 10*d.*, excluding carting of material by farm hands.

(5) Mr. F. W. C. Chartres, land agent to Major Barne, Sotterley Hall, Wangford, Suffolk, has furnished the writer with particulars of two concrete silos erected in his neighbourhood, one on Major Barne's Estate, and the other on an adjoining farm.

The total cost of one of these, of which an exact account was kept, was £120, including carting shingle 5 miles, and cartage of all other materials.

The specification of this silo is as follows:—

The silo is 15 ft. in diameter, with 3-ft. foundation, and 6-in. floor; walls, 12 in. thick, 27 ft. high; 3 windows, which are covered by wooden chute, fixed on 4½-in. by 3-in. oak uprights, across which, and inside the chute, are nailed the wooden steps. Mr. Chartres does not approve of iron steps, considering them dangerous in frosty weather.

Two rolls of galvanised wire netting were used in the walls. The silo was finished off with smooth cement face both inside and out, and has a conical roof of corrugated iron, well timbered, and with two ties across. This roof took 32 sheets of corrugated iron.

The top of the wall just comes level with the ground, owing to the building being placed in an old sand pit, thus doing away with the need of a blower, so that the tenant will have very little expense in fitting machinery.

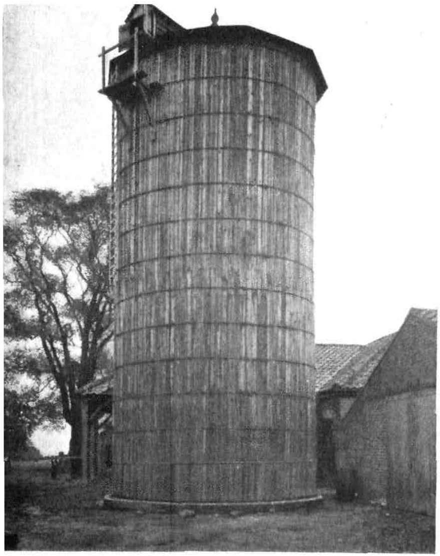

FIG. 1.—Creosoted Stave Silo.

FIG. 2.—Concrete Silo.

The Board are indebted to Messrs. Jewson and Sons, Norwich, for the use of the photograph from which Fig. 1 was prepared.

Thickness of Concrete Walls Necessary.—Mr. Joseph Webb, Surveyor to the East Suffolk Education Committee, states that in his opinion a smaller thickness than 1 ft. of concrete would suffice for the walls. The writer is not aware of any British experience on the point. Anyone thinking of erecting a silo with walls less than 1 ft. in thickness would be well advised to obtain expert advice. It is worthy of note that up to the present no signs of cracking have appeared in any of the above silos. The first four mentioned have been filled with silage at least once.

The type of concrete silo most suitable for ordinary farming conditions is, perhaps, that built by Mr. Oldrin or Mr. Balls, or at Sotterley or Walpole. Mr. Robinson's silo, the first to be built in the district, was of the nature of an experiment, and has proved rather too large.

Wooden Stave Silos.—A number of silos of this type have been recently erected in East Anglia. Perhaps the commonest size is 16 ft. internal diameter and 32 ft. in height. A concrete foundation is made. The staves are bound round with iron bands at intervals in the same way as a barrel, except that the whole structure is cylindrical and does not bulge in the middle.

Doors are arranged in the side of the silo, one above the other from the ground to the roof, each door being sufficiently large to admit the body of a man. The doors serve for the removal of the silage. In some cases a wooden chute is arranged to guide the silage down, whilst in others an arrangement of bags forming a pipe suffices for this purpose.

When the silo is full, each door is usually held in its place by a screwing-up arrangement, whilst a bar across the door serves as the rung of a ladder, enabling workmen to climb up to the top of the silo. The cost of this size and type of silo has varied from £100 before the War to about £157 10s. now.

The chief objection to wooden silos is their apparently temporary character. The writer is not aware of any information in this country as to the durability of wooden silos, the oldest silo of this type known to him having been erected only 4 or 5 years ago. It is stated in Bulletin No. 200 of Colorado Agricultural College (page 11) that in America the life of the stave silo varies from 5 to 20 years, according to the quality of material used, the method of construction, and the care and attention given to the silo.

Octagonal Wooden Silos.—Two silos of this type have been erected by Mr. Arthur Symonds, Rockylls Hall, Shelland, Bury

St. Edmunds. They are of a much more substantial appearance than the stave silos, and they cost rather more money.

Comparison between Wooden and Concrete Silos.—To make an adequate comparison between the two types of silos three main points must be considered:—

1. *Quality of Silage Made.*—If the same material is used in filling wooden and concrete silos it is not probable that the main bulk of the silage from one type is in any way inferior to that from the other. A former milk recorder of the East Anglian Milk Recording Society (Mr. F. F. Frost), who has had an opportunity in the course of his rounds of frequently inspecting the silage from both wooden and concrete silos of members of the Society, considers that on an average there is more damaged material round the outsides of the wooden than of the concrete silos. This is probably owing to the relative ease with which air finds its way through the walls of wooden as compared with concrete silos.

2. *Cost.*—At the present time, owing to the high price of timber, it would appear that the cost of the two types does not greatly differ. The cost of concrete silos largely depends upon the ease with which suitable gravel and sand can be obtained

3. *Durability.*—There can be no doubt whatever in the writer's opinion that concrete silos will prove very much more durable than wooden ones.

The durability of concrete, as of wooden silos, will vary with the quality of the materials used and the method of construction.

In this connection the Colorado Bulletin referred to above states that "there have been failures in all types of silos, but it is safe to say that the percentage of failures is less in concrete than in most other types."

The writer wishes to express his indebtedness to all those whose names are mentioned in this article for so kindly furnishing him with data concerning their silos, and to Mr. G. S. Robinson, M.Sc., Chelmsford, for so kindly analysing the samples of silage referred to.

CONVERTING PASTURE TO ARABLE CULTIVATION:

MEANS OF OVERCOMING SOME OF THE DIFFICULTIES.

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IF a farmer wishes to grow a successful crop of spring corn upon grass land ploughed up in winter, he has to face and overcome three serious difficulties. These difficulties are:—

I. That of making the freshly-broken turf consolidate upon, and establish intimate contact with, the subsoil.

II. The insect pests which may be present in the turf, and which may attack and destroy the crop.

III. The manuring of the land.

These difficulties are intensified if the date of ploughing is delayed, or are reduced if the ploughing can be carried out in early autumn, or better still if the field has been fallowed during the previous summer. The present article is confined to the question of growing corn upon pasture broken up after Christmas.

I. **Consolidating the Freshly-Broken Turf.**—The surface soil of a grass field is so tenaciously held together by the roots and stems of the plants composing its turf, and so consolidated by the trampling of the grazing stock, that, when it is ploughed up and subsequently harrowed, it does not readily disintegrate; consequently, if such a field is ploughed in the ordinary way without special precautions, each furrow is left lying against its neighbour (see fig. 1) with a considerable empty space between it and the subsoil. In the case of arable land, cultivations subsequent to ploughing serve to obliterate these empty spaces, but the tenacity of the freshly-broken turf prevents the furrow from breaking up, so that the spaces persist throughout the following season, and the ploughed surface does not become consolidated upon the subsoil.

These spaces, and the absence of close contact between the surface and the subsoil, are a serious source of danger to any corn crop which may be sown, either in a dry season or a wet one. In a dry season the surface soil quickly dries out owing to evaporation, not only from its upper surface, but also through the air-spaces below the furrow, and the crop suffers in consequence. In a well-prepared seed-bed, in which contact between surface and subsoil is properly established, the moisture soaks up from the subsoil to the surface (just as through a sponge) to supply the crop, and in addition the crop roots are able to penetrate from the surface soil to the subsoil; but when contact is not properly established neither of these two processes can be efficiently performed, and the crop dries out. In a wet season the loose condition of the seed-bed prevents the corn from obtaining a firm foothold, so that it tends to become root-fallen and subsequently laid.

In order to overcome this state of affairs the following method of procedure has been found satisfactory:—

Careful Ploughing and subsequently Pressing the Furrow. It is especially important that the ploughing should be

FIG. 2.—Ploughing after being "cart-wheeled."

carefully carried out; it is not sufficient to turn the furrow over at an angle of 45 degrees—the ploughing which is normally accomplished by the iron plough—but the ploughman must attempt to emulate the work of the Kentish plough and ploughman, and turn the furrow completely upside down. In order to accomplish such work a long-breasted plough should be used, and the breast must be set wide, to leave a wide open furrow, into which the furrow-slice may be dropped as it is turned. In doing such ploughing all grass should be completely buried, and this may be facilitated by using a skim coulter and a drag chain attached to the knife coulter.

In pressing the furrow, a good method of obtaining the desired end consists in pressing each furrow with a narrow cart-wheel. In order to accomplish this, a horse and cart should be driven close behind the plough by a boy who should sit upon the furrow side of the cart, so that his weight may help to press upon the furrow; the horse should walk in the open furrow and the wheel of the cart should

run upon the crease between the second and third furrows last ploughed. In this way the wheel presses the right-hand side of the second furrow (which is lying loosely upon the third furrow) tightly upon the subsoil, and helps to establish close contact between surface and subsoil (see Fig. 2).

In some districts special implements called furrow-presses are in use; these consist of several small but heavy, adjustable iron wheels fixed upon a common axle. The wheels are adjusted to the widths of the plough-furrows and, when used, may press several furrows at the same time, doing similar work to the cart-wheel. This implement should follow closely behind the ploughs, so that the furrows may not become wet and sticky by following rain before they are pressed.

It is important to notice that a flat roll or ring roll cannot be made to do the work of the cart-wheel or furrow-press, because their weight cannot be concentrated upon the critical point of the ploughing where the hollow space exists.

In preparing the seed-bed at any time after the land has been pressed, the first harrowing should be done in the same direction as the ploughing, since if done across the furrow the ploughing is likely to be pulled up and the turf exposed; after the ploughing has once been harrowed "with the furrow," subsequent harrowings may be done "across the furrow" without fear of pulling up the ploughing.

In Kentish ploughing, or ploughing with a balanced plough, in which the furrows are all turned in one direction, the first harrowing should be done in the same direction as that in which the furrow is turned, the harrow returning upon the ground already harrowed.

II. **Insect Pests.**—The turf of grass land provides an excellent harbour for many insects and pests, such as wireworms, leather-jackets, slugs, etc., which normally feed upon the plants composing the turf, but, when this is ploughed under and killed, must seek some other food. As soon as the sown crop starts growth, therefore, they begin to feed upon and destroy it. The damage done by these pests is often very serious and in some cases may result in complete failure of the crop.

Unfortunately, there is no practical means, short of paring and burning the turf, whereby these pests can be destroyed before the crop is sown. The only procedure for the farmer to adopt is to give his crop every possible advantage during the early stages of growth, to enable the seeds to germinate

quickly, and the young plants to "grow away from" the attack of pests, since the chief damage is done in the seedling stage.

Emphasis has already been laid upon the importance of carefully preparing the ground for the purpose of establishing the correct texture of the seed-bed; these refinements are equally important in helping the crop to resist the attacks of insects, for, if the seed-bed is badly prepared, the plants grow slowly and the pests have a longer period in which to kill the crop.

The seed should be sown when the seed-bed is in its best working order, well-prepared and warm, so that germination and subsequent growth may be as rapid as possible.

III. **Manuring.**—The importance of stimulating the crop to quick growth in its early stages to enable it to resist insect pests, has been indicated above; in this respect manuring is of the utmost value, but under-manuring of freshly-broken pasture is very liable to occur. It is a matter of common knowledge that the turf of pasture contains an abundance of residual plant food, but it is often forgotten that it is some little time, after the turf is broken up, before this residue becomes available for the corn crop. After ploughing, the plants composing the turf are not instantly killed, but remain in the soil for some weeks before death finally results and decomposition begins; moreover, up to the time of ploughing, the plant-roots of the turf have been active, and will have completely absorbed all the plant food as it became available. When, therefore, recently ploughed turf is immediately cropped with corn there is a considerable danger that the available plant food will be insufficient, and that in consequence the corn will start to grow slowly and be crippled by the attack of wireworms, etc.

In this connection may be mentioned the clause in the War Office contract for growing oats upon freshly-broken pasture, providing for the compulsory use of manures.

Two elements of plant food are especially necessary for corn crops in order to give the plants a good start. These are, (1) a quickly-active nitrogenous manure, which at the present time should be sulphate of ammonia, to stimulate rapid vegetative growth of leaf and stem; and (2) a phosphatic manure, since phosphates are specifically associated with root growth, a matter of considerable importance upon such seed-beds as result from freshly-broken pasture. A dressing of 3 cwt. of superphosphate or 4 to 5 cwt. of basic slag applied as soon as the land is ploughed, and 1 cwt. of sulphate of ammonia at seeding time will generally be most suitable.

FARMING ACCOUNTS: COST OF PRODUCTION.

THE question of cost of production in relation to agricultural products has been brought prominently to public notice in connection with the action taken by the Food Controller in regard to potatoes. It will not be out of place, therefore, to consider some of the principles which should guide an accountant in dealing with this very complex subject. It is well known that "costing" in relation to manufacturing businesses has received very careful consideration in recent years, and the literature on the subject is extensive. It is currently accepted that cost accounting is now an indispensable part of the organisation of every successful manufacturing concern, and it is constantly asserted that farmers would derive great advantages from the keeping of cost accounts. It cannot be said, however, that those who take this view have succeeded in convincing agriculturists, and it is the purpose of this note to indicate the reason which may be given in support of the view taken by farmers generally, and to suggest subjects of investigation for those interested.

One of the difficulties in the way arises from the fact that the business of farming, viewed as a manufacturing concern, differs in many vital respects from other businesses. Many of the text books on farm accounts have failed to give due weight to this fact.

First of all, it is material to consider the objects which the manufacturer has in view in keeping cost accounts. Clearly, he wishes to know (1) whether the article which he manufactures returns an adequate profit; and (2) if it does not, whether it is feasible to reduce the expenditure on any of the items of which the cost account is made up. For example, if the article in question is a plough, he may examine the cost of the iron employed with a view to ascertaining either whether the same quality cannot be obtained at a less cost elsewhere than the usual source, or he may institute an experiment to find out whether a cheaper quality of iron will not be equally useful, or it may happen that, having made these inquiries, he may abandon the manufacture of ploughs and start the making of some other article for which his labour and plant are suitable.

Can these objects be paralleled in regard to farming? Clearly, only to a limited degree. Take the case of "roots"; let it be assumed that an accurate cost account has been produced and that it shows that roots are not profitable, a result which, be it

noted, is not incompatible with a profit on the rotation as a whole. The farmer, as a rule, cannot abandon the growing of roots; they are necessary both as a cleaning crop and as providing a cheap, succulent, fresh food for his stock. His only alternative may be to decrease the area under roots, that is, he may lengthen his rotation. If, however, he lengthens the rotation (for example, substitutes a 5-year for a 4-year "course"), he alters the whole economy of the farm, and may thereby diminish his profit on the rotation as a whole, for the production of cereals will diminish, the head of stock carried will probably be altered, and the outturn of dung lessened. More artificial manures may be bought and it is, consequently, impossible to predict what the result may be. Again, if the cost account of a corn crop is considered it should be realised that some portion of the cost of the labour and manures expended on the preceding crops of the rotation should be debited. What that portion should be there is, ordinarily, no means of ascertaining exactly. An experimental change of system is full of risk. The most the farmer can do is to find a farm exactly similar to his own in which another rotation is followed and attempt to learn by observation (or, if he is fortunate, by inquiry) what the financial results on it are.

These are the arguments employed by those who maintain that the only cost of interest to the ordinary mixed farmer is the cost of the rotation as a whole, and that the cost of a single crop—if it can be ascertained, which they doubt—is an item which has no practical value, and cannot be used as a test of policy. It cannot be denied that this argument is difficult to combat. Nevertheless, it does not appear to be a complete answer to the advocate of cost accounts. Though it may be admitted that the costs of individual crops may not clearly point to the need of a change of policy, they may eventually serve a useful purpose if kept for a series of years, or if they can be compared with similar accounts kept by others on similar farms. For example, the item "labour" will show a certain cost per acre. If in a subsequent year this cost goes up, it will direct inquiry to the causes of the rise, such as inefficient supervision, improper maniplation of tools, defective implements, etc. If the accounts of neighbouring farmers are available, the possibility of extending the scope of inquiry is widened; for example, the number of hands employed may be considered. Again, if these accounts passed through the hands of an accountant, who was in the habit of dealing with similar accounts from other farms, his expert knowledge might be fruitful.

At any rate, these considerations point to the futility of some of the estimates of the cost of growing potatoes which have recently appeared in the Press. These accounts proceed on the assumption that the price realised for the crop must cover all the "cost" of the one crop, whereas it is manifest that since potatoes are a fallow crop, and consequently may benefit all the succeeding crops in the rotation, they cannot be charged with the whole cost either of the cultivations or of the manures. The real profit or loss on a crop of potatoes depends, therefore, on the price realised for the succeeding straw crops and possibly on the value of the "seeds" which will follow. The exact sum which should be deducted on this account is still the subject of argument. It cannot be settled *a priori* and can only be ascertained by accurate research over a series of years. That the deduction is considerable is clear from the fact that the root crop is occasionally given away in return for the manure of the animals folded upon it.

Another respect in which farm accounts differ from those of a manufacturer is this. The farmer in many cases does not begin his year with the definite object of producing (*i.e.*, selling *off* the farm) a definite article. For example, he may, as his judgment directs, either sell his hay or feed it to stock; or, as the season and prices direct, may sell or feed some of his cereals; if his root crop is good he may buy additional stores for fattening, buy more cake and produce more dung. One year he may substitute potatoes for turnips in part of the fallow break, and thereby remove potential fertility from the farm which, again, must be recouped by the purchase of manure. It would appear that this aspect of the farmers' business complicates "cost accounting" more than any other. Cost accounts are generally concerned with material produced for sale rather than with articles subsidiary to the first. As soon as the alternatives of selling or consuming on the farm present themselves, cost must receive a different consideration. If an article which might be sold is consumed on the farm it must be charged at market price as distinct from actual cost price. If it is debited at market price it must be credited to another account at the same figure, otherwise the accounts as a whole will not balance. In so far as the market price has not been realised in cash the accounts become puzzling to anyone but the trained accountant. If, on the other hand, the actual cost price is debited to the article finally sold, there is no indication whether it was more (or equally) profitable to consume than to sell. The simplest system of farming which has a manufacturing parallel

is that of a farm which sells a single product, say, meat or corn, or, simplest of all, milk, but it may be questioned whether the number of such farms is large. It is not intended to suggest that these difficulties are insuperable, but it may be doubted whether the writers on this subject have hitherto succeeded in solving them.

Two more problems may be mentioned of which the solution is still wanting. They may be described as the horse cycle and the manure cycle. In the conventional system of accounting generally adopted by agriculturists there are two items for which more or less conventional figures are employed—cost of horse labour and cost of dung. Since the cost of horse labour must include a charge for food which the horses consume it is obvious that a guess must be made in ascertaining the cost of a crop. And, similarly, since the cost of dung must eventually include a charge for the food of which it is a product, an estimate must be made at some point of the cycle.

Possibly these estimates may be fairly accurate—and if followed consistently provide material useful for comparison—but they remain guesses, and as such should not figure in the handiwork of an accountant.

Lastly, there is the rent difficulty—how it should be apportioned as between land, farm buildings and farmer's house, between grass and arable, between soils of different qualities, *between different crops?* The last category is inserted because, on the usual theory, rent should follow profits—an article which yields a larger gross profit should bear a higher rent. If, as sometimes occurs, roots must be grown as a cleaning crop at a loss, they should not be charged with rent.

In conclusion, it may be stated that the object of this note is not purely destructive, but rather to suggest the need of further consideration and investigation, more especially in the direction of research in regard to the apportionment of charges between various cost accounts. It should be possible by means of carefully designed experiments to determine the basis on which such apportionments should be made. In farming accounts these apportionments are crucial and fundamental: the whole theory of "costing" individual crops depends upon them, and until they are placed on a firmer basis than personal opinion their economic and scientific value is small.

PLANT-BREEDING AND CONTROLLED SEED FARMS.

THE need for increasing the arable area is now fully recognised, and it may safely be predicted that by one means or another farmers will be induced to plough up considerable areas of grass land. There are, however, other means by which the production of food can be increased, and of these, one of the most important is to secure the widest possible use of improved varieties of agricultural seeds. It is, perhaps, not generally recognised that the possibilities in this direction are great and that already noteworthy progress has been made—more especially in regard to wheat, and to a less degree in regard to barley and oats. It cannot be said, however, that much has been done in recent years to improve the varieties of roots, the rotation grasses and clovers, or the minor varieties of field crops, in respect to all of which improvement is possible.

To illustrate the magnitude of the issues involved, it may be stated that the introduction of an improved variety of barley known as "Plumage" has probably added at least £250,000 to the value of the barley crop in the Kingdom. This statement is based on the fact—which is indisputable—that this barley gives on the average an increased yield of 10 per cent, and it is estimated that the variety in question occupies annually an area of at least 250,000 acres.

Again, it has been ascertained that in the year 1916 about one-half of the acreage of wheat in the Cambridge area consisted of improved varieties produced in recent years by the Institute of Plant Breeding, Cambridge. In regard to the principal of these wheats, "Little Joss," the increased yield over older varieties is probably considerably more than 10 per cent., and it has the added merit of being highly resistant to "Yellow Rust"—a fungus which is believed to be responsible for losses in yield which, on the average, probably exceed 10 per cent.

At this point it is necessary to draw a marked distinction between the new varieties put on the market by the usual trade agencies and those produced by approved scientific methods of hybridisation and selection. It is not denied that the former agencies have been successful in producing improved varieties of farm seeds, but there are two respects in which their methods are open to criticism. First, they are empirical, and of the hit-or-miss order, and, secondly, there is reason to believe that in producing their stocks many have

not followed the only method by which a "pure" stock can be produced.

Modern scientific work has demonstrated beyond all possibility of doubt that in producing a new variety of cereal the seed must all be descended from the produce of a single ear or plant. For many years the pioneer plant-breeding station in the world—Svalöf in Sweden—endeavoured to improve existing varieties by "mass selection," that is, by "growing on" the progeny of a number of plants which appeared to possess the desired characteristics. It was found that constancy of type could not be secured by this method, however uniform the original selection might appear.

For many years now, the work at Svalöf in regard to wheat, oats and barley has been based on multiplying the progeny of a single ear or plant, with results which have earned wide recognition. Much of the success which has followed the work at Svalöf has been attained by simple selection. When any of the old-established varieties of cereals are examined, it is often found possible to distinguish individual plants which differ markedly from the majority of the others. These differences are often morphological. For example, the ear may be longer, the straw may be stiffer, the tillering may be greater, and so on. These morphological differences may, or may not, indicate latent variations in valuable economic qualities; for example, one plant may produce a greater yield of grain than another. If, then, it is considered desirable to perpetuate the variation—whatever it may be—the grain produced by *one plant* showing these characteristics is sown and harvested separately. If the variations noticed in the parent appear again in *all* the offspring—and not otherwise—the seed is grown on in the sure confidence that the selected variation is "fixed" and will continue to appear generation after generation. If, on the other hand, the selected variation does not reappear in the first generation, the grain is rejected, for it has become evident that the variation observed was due to some difference in soil or situation, and was not due to a germinal difference in the constitution of the plant.

This purely selective method, however, has its limitations. The plant breeder can now proceed more rapidly, for he can, by modern methods of hybridisation, set out to *make* a variety combining the characteristics of which he is in search. If, for example, he wishes to produce a variety of wheat with a short straw (a desideratum in the Fen districts) combined with a high yield, he can unite these two qualities in a new

variety by crossing a long-strawed high yielder with a short-strawed wheat which gives a low or indifferent yield. After the cross is made a certain routine, determined by "theoretical" considerations, must be followed, and it may be some years before a single plant which breeds true can be produced. When such a plant has been obtained, the stock of seed must, as in the selection method, be built up from a *single plant*.

It will be evident from what has been said that the production of a new variety, whether by selection alone, or by hybridisation, is a task which demands special skill and knowledge, and is one, moreover, which offers difficulties and delay to the commercial seed-grower. Even the comparatively simple task of multiplying the progeny of the single plant is one that requires careful watching. The accidental admixture of stray seeds of a different variety must be prevented and the "rogues" carefully sought out and destroyed. Special threshing machines must be employed, and careful attention given to storage. The difficulties, however, do not come to an end when the new seed is put on the market. Experience shows that in a very few years the pure variety gets mixed with others, and degeneration sets in which generally proves progressive. There is a popular belief that this degeneration occurs in the variety itself. This is not so. A moment's reflection will show that our cultivated varieties of cereals could not have persisted as they have done had this been the case; they would long ago have "reverted" to the wild grass type from which they were probably evolved. Nor in the case of cereals does degeneration occur from intercrossing. In this climate wheat and barley certainly, and oats practically invariably, are self fertilised before the flower organs open, so that crossing, if it ever occurs, may be disregarded as a potential cause of degeneration.

There can be no doubt, therefore, that degeneration, if it appears, is the result of admixture of foreign seed of which the commercial migratory threshing machine is the principal cause. How then can this admixture be prevented? Clearly, by two measures: (1) The careful growing on of pure stocks under proper supervision; (2) The placing of seed guaranteed pure on the market year by year.

Further, it is clear that whatever the agency for securing these ends may be, it must be under some official or semi-official supervision, and that supervision must provide for the co-operation of the experts who were originally responsible for the production of the new variety. We are thus led inevitably to the conclusion that the time has come for the establishment

of a Seed Control Agency which shall be administered in association with the Research Institutes concerned with plant-breeding, which shall be supported, if necessary, by the State, and which shall serve as a centre of distribution, not only of new and improved varieties of seeds, but also of guaranteed "pure" stocks of the established varieties of proved merit.

Now this is what Sweden has had for many years, and it will be desirable to conclude with a description of the organisation of Svalöf and to give some particulars of what it has achieved.

Swedish Society for the Improvement of Seeds.—The question of seed supply had already long been prominent among Swedish agriculturists when various farmers in South Sweden founded, in 1886, the "Society for the Improvement of Seeds in South Sweden." This society excited so much interest that it rapidly extended, absorbing in 1889 a similar society for the Central Swedish provinces and becoming the "Swedish Society for the Improvement of Seeds." One after another all the Swedish Agricultural Associations (even the most northerly ones) sent in subscriptions, and lastly the State also made a grant. The society consists of both life members and annual members with a life and annual subscription respectively. Of the management committee of seven members, three are elected by the society, three by the delegates of the Agricultural Associations, and one by the State.

The aim of the Society is to produce, by a system of selection and hybridisation, new and improved varieties of farm crops giving higher yields and of a better quality.

Field tests are conducted every year over many thousands of plots. By local tests it is sought to determine the value of varieties under diverse conditions of climate and soil, Sweden being exceptionally favourably situated for this purpose.

Until 1903 selection was limited to cereals, vetches, and peas. Since then, clover, forage plants, and potatoes have been bred. In 1909 sugar mangolds, mangolds, swedes and garden turnips were taken in hand.

The starting point in producing a new species has, since 1892, usually been a single plant, and hybridisation on the basis of Mendel's laws has for some years successfully been resorted to, with the object of producing new forms by the combination of the useful characters of existing varieties.

The fact that a new variety has been put on the market does not mean that the process of breeding is stopped; on the

Hand-hoeing at Svalöf.

Harvesters at Work at Svalöf.

contrary the work is continuous, the aim being to continue to create new strains.

For a full account of the scientific methods at Svalöf the reader is referred to an article by Mr. R. B. Greig in this *Journal* for August, 1910, p. 379.

The funds required for carrying on the work come from various sources. The members' annual subscriptions yield an average of about £147; the Agricultural Associations have given about £885 a year—lately rather more (£1,100); the State gave £833 a year from 1890 to 1905, £2,222 from 1905 till 1912 inclusive, and in 1913 gave £2,777. It was then proposed to raise the State grant to £4,444, but it is not known whether this has been done. In 1915-16 the Society received a contribution of £3,333 from the General Swedish Seed Company. This Company was formed to take over the agricultural and commercial work of the Society, leaving the latter with purely technical duties (see later) The income of the Society before the War had reached between £6,000 and £7,000.

Out of the subscriptions of life members a fund was set apart for buildings; these were further liberally endowed, the total endowment before the War being about £15,300. The Society has now a large and well-equipped establishment (erected at a cost of £16,000), comprising two buildings for laboratories, a building for seed preparation, a small farm and a dwelling-house. The land occupies 40 acres, of which 25 are reserved for special plots and for increasing the seed supply. It has, however, been found necessary to grow the greater number of the trial crops—the real experimental plots—on the large estate adjoining (see below).

It should be noted that, in the main, this Society is concerned with the scientific aspects of the work. The commercial organisation is in the hands of the General Swedish Seed Company.

The General Swedish Seed Company.—The production of improved varieties of crops soon outgrew the capacity of the scientific staff to organise the sale of seed and oversee the commercial side of seed production. In 1891, therefore, there was founded the General Swedish Seed Company, Ltd., for the purpose of increasing and distributing the new stocks. There are thus two organisations at Svalöf, perfectly distinct in both administration and finance, though they are often confused under the general name of "Svalöf Institute." The Company purchased an estate next to the Society's land, containing some 1,500 acres of first-class fields, where most of the field trials of the Society are carried out, and it controls

3.700 acres for the further increase of crops. Special stores have also been built. The Company further possesses two well-equipped branches in Central Sweden.

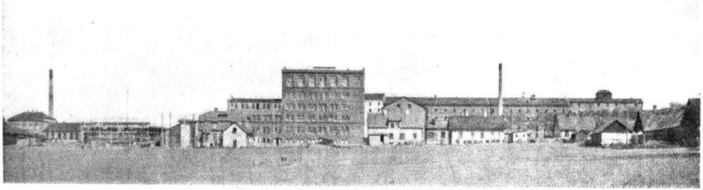
The relations between the two organisations were approved in 1909 by the Government, and are under its supervision. Under this arrangement the Company takes the new varieties produced by the scientific staff of the Society as soon as they are ready, generally in amounts of only some 220 lb.; they are then increased under the direction of specialists. The subsequent cropping on a large scale, which has to be carried out on the Company's farms in the different provinces, is also under the same expert inspection. Further (and this is most important and essential), the *Society* examines the crops when sent to the *Company's* store, supervises the cleaning and sorting, analyses samples, seals the seed sacks and sees to the final despatching, so that the purity of the seeds sold by the Company is beyond criticism.

The varieties already handed over to the Company remain under the observation of the Society, so that new lines may be introduced into the Company's varieties, when desirable. *In this way the Society remains responsible for the purity of the varieties on sale.* The Company alone has the right to carry out the breeding of the Svalöf strains (under the supervision outlined above), and to sell the original seeds. In return for these privileges the Society receives from the Company the annual contribution referred to above. Under certain conditions the Company has to hand over to the Society part of the surplus profit.

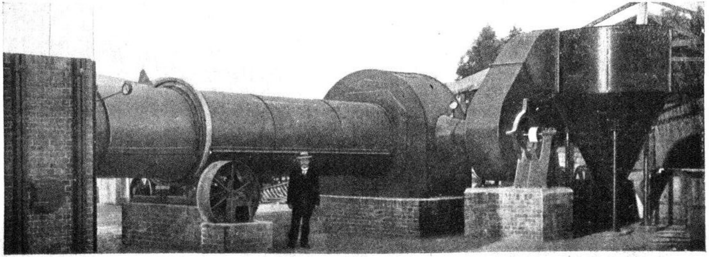
The share capital of the Company in 1891 was £4,437, and has gradually risen till in 1910 it reached £50,000, at which figure it has since remained. The Company commenced to pay a contribution of £92 to the Society in 1893; this also has gradually risen until in 1916 it stood at £3,333. A profit of £193 in 1891 has now become one of £8,300.

The transactions of the Company in 1915-16 amounted to £420,255, and the Company in that year had 34,300 open personal accounts. In addition to the financial success of the Company, it is estimated that the cereal crops of southern Sweden have been increased by from 30 to 50 per cent. as a result of the work at Svalöf. The good results obtained from Swedish varieties of barley and oats (to take two crops) throughout England will be found in this issue of the *Journal*, pp. 1057–1062.

The current profit and loss account and balance sheet of the Company are given below. The magnitude and success

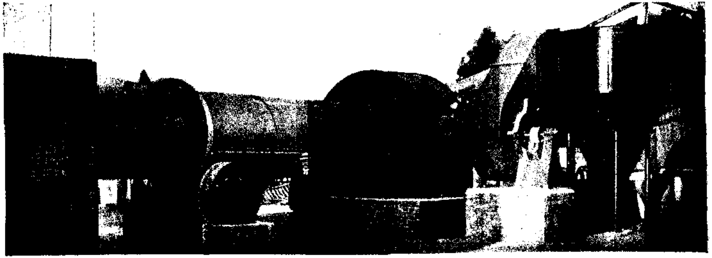


Seed-Cleaning House, Mill, and Storehouse at Svalöf.



Drying Apparatus at Svalöf.

Seed-Cleaning House, Mill, and Storehouse at Svalöf.



of the operations are a remarkable testimony to the benefits that follow the application of scientific skill and knowledge to agricultural problems.

Profit and Loss Account,

1st August, 1915—31st July, 1916.

Dr.	£		Cr. £
Depreciation	6,699	Miscellaneous	630
Interest	9,317	Agricultural Operations ..	3,061
Contribution to the Society	3,333	Sale of Seed	23,952
Net Profit	8,294		
	£27,643		£27,643

Balance Sheet,

31st July, 1916.

Liabilities	£	*Assets.*	£
Share Capital	50,000	Estate	92,049
Reserve and Stock ..	33,479	Machinery and Fixtures	30,448
Debts Payable	193,852	Stock in hand	25,941
Profit	8,294	Debts Receivable ..	130,222
		Shares	6,595
		Cash in hand	370
	£285,625		£285,625

Manufacture of Potash from Felspar.

MOST of the potash used in this country in the past has been supplied from the deposits at Stassfurt, in Germany. Our supplies of potash salts were, therefore, cut off on the outbreak of war, and it became necessary to consider what alternative sources there were from which this essential material could be obtained. The burning of seaweed and the extraction of potash from the ash was at one time an important industry on the coasts of Scotland and Ireland, but it appeared that, even with the revival and extension of this industry, the quantity of potash produced would form a very small proportion of the amount likely to be required in the United Kingdom.

Apart from plant ash, the only British source from which any considerable quantity of potash can be obtained is felspar, large deposits of which exist in certain parts of the country.

Much attention has been given to methods for extracting potash from felspar, but up to the present no method has been commercially successful. The profitable production of potash from this source depends on the possibility of preparing a second product which would bear part of the cost of manufacture. The

solution of the commercial problem was claimed for a process patented by Mr. J. Rhodin, F.I.C., a Swedish inventor, who has been resident for many years in this country. In 1899 Mr. Rhodin described a method for rendering the potash in felspar soluble in water, and in 1912 he patented a further process for converting the insoluble residue into a white cement.

During the early part of 1913 Messrs. W. Cubitt and Company, the well-known builders and contractors, inquired into the practicability of the process and carried out preliminary investigations. These proved satisfactory, and Messrs. Cubitt and Company were about to set up a small plant for the manufacture of white cement and potash when the outbreak of war put a stop to the project.

Early in 1916 the Rhodin process was brought to the notice of the Board of Agriculture and Fisheries by Mr. A. C. Auden, M.Inst.C.E., Chief Civil Engineer of the Union Cold Storage Company, who had supervised the experiments carried out by Messrs. Cubitt and Company. Learning of the great shortage of potash for agricultural purposes, Mr. Auden submitted to the Board particulars of the Rhodin process, together with revised estimates summarising all his own inquiries and information. The subject was considered by the Fertilisers Committee, and the opinion was expressed that, as the experiments had hitherto been made with Swedish felspar only, it was desirable to test some of the British felspars, considerable deposits of which were known to exist at Roche, in Cornwall, and Loch Eriboll, in the north of Scotland.

An offer kindly made by Messrs. Cubitt and Company to place their experimental plant at the disposal of the Committee for the purpose of experiments was accepted; the assistance of the Geological Survey was invited in locating deposits of felspar in the British Isles; and a Sub-Committee of the Fertilisers Committee was formed to obtain the material required and generally to arrange for conducting the experiments. Mr. T. H. Middleton, C.B., and Sir James Dobbie, D.Sc., F.R.S., constituted the Sub-Committee, and they subsequently co-opted Mr. Auden as an additional member of the Sub-Committee.

The Sub-Committee at its first meeting made arrangements for securing samples of various British felspars, in order to select the types most suitable for the purpose.

The owner of the land at Loch Eriboll agreed to the removal, for experimental purposes, of a quantity of felspar from his Sutherlandshire property, and, through the Director of the Geological Survey, arrangements were made for a Scottish

geologist to visit the district for the purpose of selecting material. Samples of white orthoclase felspar were obtained from a deposit in Cornwall. Messrs. Cubitt and Company secured samples of Swedish felspar from Derome, near Varberg, Sweden. Through Messrs. R. W. Gould and Company, of the Hop Exchange, S.E., samples of Cornish granite, said to contain nearly 9 per cent. of potash, were obtained from Camborne. The experiments were carried out on behalf of the Sub-Committee by Mr. Rhodin, the patentee, in the experimental plant erected at Messrs. Cubitt's premises. Mr. F. S. Aumonier, B.Sc., F.I.C., of the Government Laboratory, was present at all the operations, and took samples of the products obtained at the different stages. The samples were analysed at the Government Laboratory.

After preliminary investigations to ascertain the most suitable conditions, experimental operations were carried through with the Roche, Loch Eriboll, and Swedish felspars. An analysis of the granite rock from Camborne showed that it contained a comparatively low percentage of potash and had other properties which made it unsuitable for the Rhodin process.

The Roche spar, which contained 10·8 per cent. of potash (K_2O), yielded 75 per cent. in a soluble form, or 3·2 cwt. of 80 per cent. muriate of potash per ton of spar.

The Loch Eriboll spar yielded in a soluble form 60 per cent. of its 8·6 per cent. content of potash, or 2·0 cwt. of 80 per cent. muriate per ton of spar.

The Swedish spar, which contained 12·9 per cent. of potash, yielded 54 per cent. in a soluble form, or 2·8 cwt. of 80 per cent. muriate per ton of spar. The Swedish spar was, however, not subjected to the same preliminary experiments as in the case of the other spars, and this is considered to be the explanation of the somewhat disappointing yield obtained.

The results of the experiments showed that, by means of the Rhodin process, 75 per cent. of the potash content of certain felspars can be obtained in a soluble form, while the insoluble residue can be made into a white, or nearly white, cement.

It was clear, therefore, that potash salt suitable for manurial purposes could be produced, but that the cost would be governed by the price and the demand for the main product, viz., cement. The total quantity of potash used in the United Kingdom before the War was about 23,000 tons per annum, and it was considered that the smallest quantity of felspar potash which was likely to have an appreciable effect on the home market would be from 4,000 to 5,000 tons.

The use of white cement in this country is confined mainly to decorative purposes, and not more than 8,000 tons per annum is at present used for this purpose.

In order to produce 5,000 tons of potash (K_2O) it would be necessary (on the basis of the experiments with the Roche sample) to make 136,000 tons of the cement.

It was, therefore, clear that the disposal of this product required examination; and an expert opinion on the subject was necessary.

The Ship Canal Portland Cement Company had previously examined and reported favourably on samples of cement produced by the same process; and the Sub-Committee decided to invite Mr. G. A. Watson, the Managing Director of this Company, to favour them with his opinion on the product of the more recent experiments.

The report of Mr. Watson was to the effect—

(1) that the colour of two of the three samples submitted was satisfactory (these were from the Cornish and Swedish felspars);

(2) that they were all true hydraulic cements;

(3) that the tensile strength was shown to be much lower than that of Portland cement;

(4) that this would not be an objection if the material were used entirely for decorative purposes;

(5) that for the first twelve months probably only 5,000 tons could be marketed for purely white cement purposes;

(6) that (assuming a 50,000-ton make) the balance of 45,000 tons would have to be sold (*a*) in foreign markets, (*b*) by increasing its strength and placing it on the home and foreign markets as an ordinary cement.

Mr. Watson stated further that he is prepared, under certain conditions, to purchase the output of 50,000 tons per annum of white cement at 25*s*. per ton delivered at Ellesmere Port.

As a result of the investigations described above the Sub-Committee were satisfied that the Rhodin process as investigated by them is capable of producing a cement of fair quality and a potash salt (potassium chloride) which would be suitable for manurial or other purposes.

They calculate that 100 tons of Roche spar treated by this process can be made to yield 220 tons of white cement and 8 tons of potash (K_2O), equivalent to 16 tons of 80 per cent. muriate of potash

Other sources of potash have become available since the Sub-Committee commenced their inquiries into the Rhodin process, and consequently the possibility of there being a famine in the supply of this material in the United Kingdom has disappeared. The Sub-Committee considered it unnecessary, therefore, to extend their experiments. They are satisfied as to the character of the potash product, and they are not concerned with the exploitation or the possibilities of a trade in white cement.

The Sub-Committee are of opinion that encouragement should be given to any movement for the manufacture of potash and white cement by the Rhodin process on a commercial scale, and that, in the event of a public company applying to the Treasury for permission to raise capital to work this process, the application should receive the strong support of the Fertilisers Committee. The establishment of a British industry providing for an independent supply of potash would clearly be of great value to the country.

THE following note on lime-spraying fruit trees has been communicated to the Board by Mr. A. H. Lees, M.A., of the National Fruit and Cider Institute:—

The Best Time for Lime-Spraying Fruit Trees.

Ever since lime-spraying for fruit trees was introduced there has been considerable doubt as to the best time to perform the operation. At first, the period just before the buds begin to swell or at the first sign of swelling was advised, but subsequent experience has tended towards a later period.

The question has to be considered from three points of view, *i.e.*, (1) the insect to be controlled, (2) the spray fluid, and (3) the host plant.

(1) *The Insect Pests to be Controlled.*—Most of the lime-spraying done on fruit trees is against pests of the apple, which are found in the egg stage in early spring. The important ones are four in number, namely, the apple sucker, the rosy apple aphis, the blossom and stem apple aphis, and the permanent apple aphis. Of these the first two are the most serious, and the time of spraying, therefore, should be so regulated as to give the best control for them.

In an average year the apple sucker begins to hatch at the beginning of April, and hatching continues over a period of three weeks or so, while the rosy apple aphis begins about the middle of April. To get the best results, therefore, in the control of these two insects it is necessary to make a com-

promise so as to time the spraying period in such a manner that the work shall be half done about 10th April. If much spraying has to be done then an early start should be made, but if a power sprayer is available a later start may suffice.

(2) *The Spray Fluid Employed.*—If the ordinary lime mixture is employed (lime 20 lb., water 10 gal.) it is highly desirable to put off spraying as late as possible before the eggs begin to hatch, since the time that a lime coat remains effective is limited. Its effectiveness depends on there being a firm coat over the twigs at the critical time of egg hatching, since its action is mechanical rather than chemical.

Briefly put, the following are the conditions to ensure the most effective results :—

(*a*) The lime must be fresh lump-lime of 98 per cent. purity. That derived from the carboniferous limestone should be obtained if possible. Common, impure agricultural limes are unsuitable.

(*b*) When slaking, the mixture should be allowed to get as hot as possible, but at the same time all lumps should be kept covered with water.

(*c*) The diluted lime-wash, at a strength of 20 lb. to 10 gal. of water, should be strained through a metal sieve, having 16 meshes to the inch, or holes $\frac{1}{16}$ in. in diameter.

(*d*) If it is possible so to arrange it the lime should be allowed to slake for at least six hours before use. This precaution increases the sticking power of the resulting coat, but quite good results can be obtained without it.

(*e*) The mixture should be applied through a machine and nozzle specially adapted for lime-sprays.

(3) *The Host Plant.*—It has been shown above that the best time for spraying from the point of view of insect control and effectiveness of coat is comparatively late in the season, namely, about 10th April. At this date, however, most apple trees are showing partially-open flower buds, and spray damage might be expected. In order to test whether such damage would occur, and if so to what extent, some experiments were started in the spring of 1916 at the Agricultural and Horticultural Research Station at Long Ashton.

Spraying of apples was begun on 17th March, and was continued, except during spells of bad weather, until 28th April. Many varieties were treated, and photographs were taken at

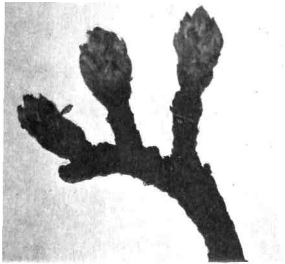


FIG. 1.—Devonshire Quarrenden (18th March, 1916).

FIG. 3.—*Devonshire Quarrenden. Hatching of* Aphis (27th March, 1916).

FIGS. 1 to 10 illustrate the condition of the flower buds at the time of spraying.

FIG. 4.—James Grieve (29th March, 1916).

intervals of trees about to be sprayed so as to show the exact condition of the buds at the time of spraying. It was felt that such a method gives a very much clearer idea of the state of the buds than such descriptions as "just as the buds are swelling" or "as the flower buds are beginning to open," which phrases can often be interpreted in more than one sense.

Table I. gives a list of apples sprayed, the date of spraying, and the amount of damage resulting therefrom. In all cases where photographs were taken representative twigs were picked immediately before spraying for the preparation of photographs. The standard spray used was a lime mixture containing 20 lb. of lime to 10 gal. of water. This was applied while still warm from slaking. The same formula spray was also used on other trees, but with the lime thoroughly cold after having slaked for six hours or more.

These two formulæ were used on still other trees, but with the addition of a certain quantity of concentrated lime-sulphur solution. The object of this was to test the power of lime-sulphur solution present in a lime mixture, to control apple scab.

The damage that resulted from comparatively late sprayings was astonishingly little.

The first sign occurred on the four varieties Lord Hindlip, White Transparent, James Grieve and Charles Ross, which were sprayed between 26th and 29th March. It did not amount to more than a slight temporary injury and did no lasting damage to the flowers. These trees had had various treatments, some of which were repeated afterwards on other trees and produced no damage. The spray formulæ were, therefore, probably not responsible. The weather, however, supplies the explanation. On 27th March there was a gale of wind, and on the night of 28th March a minimum temperature of 21° F. was registered at Long Ashton. The effect of the frost was apparently to make the very young leaves susceptible to spray damage. By 30th March this condition had passed and no more spray damage was noticed until 25th April, when the varieties Lord Derby and Cox's Orange showed signs of injury. The amount, however, was very small and of no practical importance. Houblon and Gascoyne's Scarlet Seedling also showed some injury, but neither in these two varieties, nor in any that were used in these experiments, was it ever sufficient to injure the essential organs of the flower.

These experiments, therefore, would seem to show that lime-spraying may be done for apple trees right up to the time when the flower is nearly out (27th April). At the same time it

should be pointed out that occasionally apples are damaged by late spraying, and the conditions under which damage occurs are not yet fully recognised.

Figs. 1–7 give various stages at which apples were lime-sprayed. Fig. 4 was the only stage in which scorching followed spraying, and that was almost certainly due to weather conditions. At the end of Table I. are added the results of lime-spraying on six varieties of plums and one of pears. In the case of the plums the object was to control aphis, and in that of the pears, brown rot. It will be noticed that the Jefferson

TABLE I.

Name of Variety.	Date of Spraying.	Spray Fluid Employe	Fig	Nature of Damage.
APPLES.				
Devonshire Quarrenden..	March 17-20	Lime, 20 lb.; water, 10 gal.	1 & 3	None.
Allington Pippin ..	"	" "	2	"
King of the Pippins ..	"	" "	..	"
Sturmer Pippin	"	" "	..	"
Allington Pippin.. ..	March 25-28	Lime, 20 lb.; water, 10 gal.; lime-sulphur, 1/9th gal. of concentrate.	..	"
Lord Hindlip	"	" "	..	Slight browning of scale leaves.
White Transparent ..	March 28-29	Lime, 20 lb.; water, 10 gal.; lime-sulphur, 1/18th gal. of concentrate.	..	" "
James Grieve	"	" "	4	" "
Charles Ross	"	Do., but lime slaked for six hours before using.	..	" "
Lord Suffield	March 30	" "	5	No damage.
Ecklinville	April 1	Lime, 20 lb.; water, 10 gal.; lime slaked six hours before use.	..	" "
King's Acre Pippin ..	"	" "	..	" "
" " " ..	April 3	Lime, 20lb.; water, 10 gal.; lime-sulphur concentrate, 1/18th gal.	..	" "
Wealthy	"	" "	..	" "
Rival	April 4	" "	..	" "
Warner's King	"	" "	6	" "
Cox's Orange Pippin ..	"	" "	..	" "
Bramley Seedling ..	April 5	" "	..	" "
Bismarck..	April 25	Lime, 20 lb.; water, 10 gal.	7	" "
Lord Grosvenor	"	" "	..	" "
Lord Derby	"	" "	..	Slight blackening at ends of a few leaves.
Cox's Orange Pippin ..	"	" "	..	" "
Pott's Seedling	"	" "	..	No damage.
Houblon	April 26	" "	..	Moderate blackening of leaves.
Lady Sudeley	"	" "	..	No damage.
Gascoyne's Scarlet Seedling	April 27	" "	..	Very slight injury.
Annie Elizabeth	"	" "	..	No damage.
Newton Wonder.. ..	"	" "	..	" "
Coronation	April 28	" "	..	" "
American Mother ..	"	" "	..	" "
Court Pendu Plat ..	"	" "	..	" "
PLUMS.				
Jefferson	March 14	" "	8	Slight browning of petals.
Victoria	March 15	" "	..	No damage.
Early Transparent ..	March 16	" "	9	" "
Czar	"	" "	..	" "
River's Early Prolific ..	March 17	" "	..	" "
Denniston's Superb ..	"	" "	..	" "
PEARS.				
Louise Bonne	March 1-5	Lime, 30 lb.; glue, 2 lb.; potassium dichromate.	10	" "

FIG. 6.—Warner's King (4th April, 1916).

FIG. 7.—Bismarck (25th April, 1916).

FIG. 8.—Jefferson (14th March, 1916).

FIG. 9.—Early Transparent (16th March, 1916).

FIG. 10.—Louise Bonne de Jersey Pear (1st–5th March, 1916).

flowers were just opening and no damage except a slight browning of the petals followed.

From these experiments it will be seen that spraying may take place with only slight risk of injury right up to the opening of the flowers, a date which in 1916 in the case of Bismarck was 25th April. From previous considerations it has been shown that 10th April would be about the best time, and that, therefore, risk of spray injury need not be greatly feared at that date.

It was hoped that some information would be obtained as to the date of spraying which gave the best control of the rosy apple aphis and also of the stem and blossom aphis, but, unfortunately, only extremely few eggs of these insects hatched on the control trees. This occurred not only at Long Ashton but also over the West of England, and possibly elsewhere. The reasons for this are unknown, but the fact prevented any conclusions being drawn.

Sclerotinia Diseases.*

THE diseases dealt with in this article cover those caused by the fungus *Sclerotinia sclerotiorum,* Bref., a parasite well known both in Europe and America, and capable of attacking a large range of cultivated plants, both annual and herbaceous. The method of infection and behaviour of the fungus have been most carefully studied in the case of a disease of the potato which is widely distributed in England and Scotland, and causes serious damage in Ireland. As the life-history of the parasite and the treatment to be adopted are the same when other crops are concerned, the potato disease only is described in detail.

S. sclerotiorum is allied to *S. trifoliorum,* one of the fungi associated with clover sickness and described in Leaflet No. 271, and also to *S. bulborum,* a fungus which attacks various bulbous plants in gardens.

The Stalk (Sclerotinia) Disease of Potatoes (*Sclerotinia sclerotiorum,* Bref.).—The stalk disease of potato is most destructive in the northern and damper parts of the country. In the west of Ireland the loss occasioned by it is so great that, with the exception of the ordinary potato blight (*Phytophthora infestans*), it is stated to be the most serious disease with which growers have to contend. The fungus attacks the stem, either near the ground or at some distance above it. Subsequently it

* Revise of Leaflet No. 127 about to be issued.

penetrates the inner tissues and destroys them so that the stem falls over at the affected spot and dies. Though in this disease the tubers are not attacked the yield is reduced owing to the death of the shoot, and in districts where *Sclerotinia* is widespread the crop may suffer very severely.

Description and Life-History.—In the earliest phases of attack, usually about the beginning of July, the disease shows itself in the form of white patches of fungus threads or *mycelium*, on the outside of the stem (Fig. 1).* In contrast to most stem diseases this is accompanied by but little yellowing of the foliage, with the result that infected plants are easily overlooked. If dull, damp weather prevails the mycelium develops rapidly and begins to form oval or spherical cushions, white in colour, and from which minute drops of water exude (Fig. 2). These cushions represent the youngest stages of the resting bodies known as *sclerotia*. The sclerotia consist of a compact mass of mycelium, which later becomes firm and finally hard and black, though internally it remains white. They are spherical or oval in shape, and usually about the size of a pea, but frequently much elongated. When ripe they fall off and remain dormant in the soil until the following spring. It is from the possession of these sclerotia that the fungus derives its generic name *Sclerotinia*, though it should be remembered that sclerotia are also produced by many other fungi.

In addition to forming external mycelium and sclerotia the fungus gradually penetrates the inner tissues of the stem. The cells are invaded, and the pith-cavity is filled up with fluffy white mycelium in which sclerotia, similar to those produced externally, develop (Fig. 3). The latter remain inside the stems, but ultimately reach the soil if the stems are allowed to decay on the land. The result of this internal development of mycelium is the blocking up of the water-conducting channels. At the point of attack the tissues are killed and the stem bends over, and sooner or later dies.

The fate of the sclerotia in the soil has been carefully studied by several observers. They remain dormant until early summer, when they germinate and give rise to small disc or cup-shaped bodies which produce the spores (Fig. 4). The cups are borne on slender stalks, and appear just above the surface of the soil. They are pale, brownish yellow in colour and from one-quarter to one-half an inch in diameter. These

* For the illustrations used in this article the Board are indebted to the Department of Agriculture and Technical Instruction for Ireland.

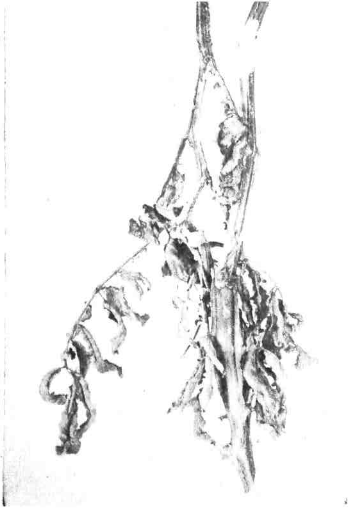


FIG. 1.—STALK DISEASE. A stalk attacked in two places, at one of which fracture has occurred.

FIG. 2.—STALK DISEASE. The white bodies on the surface of the stalks are immature "Sclerotia."

disc-shaped cups are termed *apothecia*, and they form a characteristic feature of the very large group of fungi known as *Discomycetes*. When ripe the apothecia discharge their spores into the air, usually in large numbers at a time. If the apothecia are carefully watched, smoke-like puffs of spores may easily be seen. The intermittent discharge of spores from a single cup may continue for two or three weeks.

The infection of the potato plants by the fungus was previously thought to take place by means of vegetative mycelium present in the soil, but recent investigations carried out in Ireland have shown that this is not the case, but that infection is brought about exclusively by air-borne spores derived from the apothecia. The spores are blown across the fields and alight on the foliage. On germination they are capable of infecting the older and fading leaves, and from the leaf the fungus passes into the stem. In some cases direct infection of healthy tissues apparently also takes place, especially in such spots as leaf axils where moisture is preserved.

S. sclerotiorum possesses no conidial form of reproduction. The *Botrytis* found on potato haulms, and formerly thought to be a stage in the life cycle, is now known to be an entirely distinct fungus.* In winter, Sclerotinia is perpetuated by the hard, black sclerotia in the soil, and in early summer it is propagated by means of the spores liberated from the cup-shaped apothecia.

Infection of other Crops.—As mentioned above, many other cultivated plants are attacked by *S. sclerotiorum*, of which the following are amongst the most important :—Tomato, artichoke, sunflower, bean, marrow, cucumber, carrot, and turnip. Though in few of these the fungus attack has been carefully studied, it is safe to assume that infection takes place by means of spores or by mycelium derived from a spore. Infection by mycelium produced from sclerotia may, perhaps, also take place. Spore-infection probably occurs, as in the potato, through old leaves or wounded surfaces, though under conditions of exceptional moisture direct infection of healthy tissue also may be expected. In all cases sclerotia are produced

* The fact that both these fungi produce sclerotia, and that frequently they both occur on the same plant, has been the cause of much confusion in the past. In *Botrytis* the sclerotia are small and wrinkled and are almost always flattened. They remain attached to the potato stems and on germination give rise to the mould stage of *Botrytis cinerea*. In *S. sclerotiorum* the sclerotia are much larger and rounded in form. Microscopically, also, they show a slightly different structure. They easily fall from the plant and produce on germination the small cup-shaped apothecia. *Botrytis cinerea* is much more common than *S. sclerotiorum*. For Botrytis diseases, see Leaflet No. 234.

in abundance. These fall to the ground or remain in the dead tissues of the plant, where they lie dormant till the spring, when they germinate or form spore-cups in the usual way. Disease seldom appears before midsummer, and is favoured by warm, damp weather.

Treatment.—(1) The most important measure to adopt is systematically to collect and burn all diseased portions of the plant in order to prevent the sclerotia from reaching the soil. If this is carried out thoroughly the number of spore-bearing cups produced in spring will be largely reduced.

(2) Treatment of the soil with lime in order to kill the sclerotia has not proved of any value, and experiments on spraying plants and soil with fungicides, with a view to killing the spores and spore-cups, have not yielded satisfactory results.

(3) For greenhouse or garden work sterilisation of the soil by steam may be recommended.

(4) Unless the soil has been sterilised, plants liable to be attacked by Sclerotinia should not be grown for at least three years in infected soil. The fresh site selected should be well removed from the old one.

(5) In the case of potatoes, in the west of Ireland, late planting has proved successful, the explanation of the greater immunity of late crops being that fewer old leaves (which provide the fungus with an easy means of entry) are available at the time of the main spore-discharge.

(6) When root crops are concerned, the greatest care should be exercised as to storage, and all diseased or damaged roots should be rejected.

Ammonium Sulphide Wash for American Gooseberry-Mildew.

THE following note has been communicated to the Board by Dr. J. Vargas Eyre and Mr. E. S. Salmon, of the Research Department, South-Eastern Agricultural College, Wye, Kent :—

An extensive series of experiments which was carried out during 1916, partly in the glasshouse and partly in the open, has again demonstrated the value of ammonium sulphide as a fungicide against "powdery-mildews" (*Erysiphaceæ*) in general and particularly the American Gooseberry Mildew. The details of these experiments show how completely the results of last year's spraying trials corroborate the results published by us in this *Journal* for February, 1916.

Necessity for Using Soap.—It is desired, however, to emphasise once again the importance of using soap in this

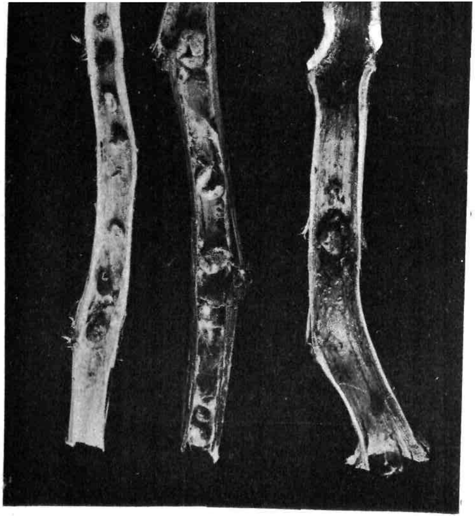


Fig. 3.—Stalk Disease. Three potato stalks split open showing numerous "Sclerotia" in their hollow interiors.

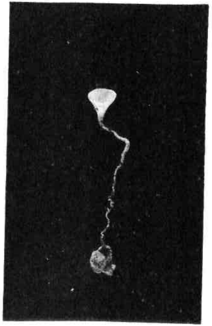


Fig. 4.—Stalk Disease. A single "Sclerotinia" which, after lying dormant during winter, has produced a spore-bearing cup or apothecium (nat. size).

spray fluid. In order to ensure a satisfactory wetting of the mildew—without which it can be only partially effective—it is absolutely necessary to use the wash containing 0·5 per cent. of soft-soap even when soft water is used in its preparation, *i.e.*, 5 lb. of soft-soap per 100 gal. of wash.

New Stock Solution.—It is thought advisable, for practical reasons, to place on record now a new method of making this fungicide which makes it possible to prepare a more highly concentrated "stock solution" than the one previously described. After numerous preparations had been made, in which varying amounts of sulphur were dissolved and the fungicidal value of these several preparations had been ascertained by delicate biological tests, evidence was obtained that a stock solution of ammonium sulphide, prepared as described below, is as efficacious when diluted to 1 part in 100 parts as is the stock solution described last year when diluted to 1 part in 20 parts. Besides being more easily handled by reason of its more concentrated form, there is every reason to believe that when made according to the new formula, the ammonium sulphide wash will now be procurable on the market at a cheaper rate.

Preparation of the New Stock Solution.—The preparation of the new concentrated stock solution may be conveniently effected by saturating one-third of a gallon (1·53 litres) of aqueous ammonia of sp. gr. 0·895 at 16° C.—*i.e.*, 30 per cent.—with sulphuretted hydrogen gas until the sp. gr. of the liquid becomes equal to 1·075 and its volume 1·55 litres. It is then mixed with two-thirds of a gallon (3·06 litres) of 30 per cent. ammonia solution, and to this mixture 2 lb. 7 oz. (1101 grms.) of flowers-of-sulphur are added and dissolved by stirring. A moderately slow current of sulphuretted hydrogen gas is again passed through the clear solution until its sp. gr. becomes 1·085 at 16° C. Owing to the increase in the volume of the liquid which takes place during the preparation, more than 1 gal., namely, slightly more than 5 litres of the concentrated stock solution, is finally obtained.

It will be obvious from the above description that the stock solution of ammonium sulphide is not one which can be prepared by the grower himself. Further, since this stock solution cannot in practice be tested by the grower, it should be purchased only from firms of repute who will vouch that it has been prepared according to the method described above.

Dilution.—**To prepare the diluted wash from the above stock solution, in the case where the water used is "soft," 5 lb. of**

soft-soap of a reliable brand should be dissolved in 99 gal. of water, and into this quantity of soap solution 1 gal. of the stock solution of ammonium sulphide should be mixed by stirring. In this manner 100 gal. of wash are prepared ready for use. In cases where the water used is "hard" a proportional increase must be made in the amount of soap used unless other means are adopted for softening the water.

With regard to the method of applying this wash and other details, also the relative values of ammonium sulphide and lime-sulphur, reference should be made to this *Journal* for February, 1916.

The Cultivation of Parsnips.*

THE parsnip is of more value as an article of food than is commonly supposed. It contains about 17 per cent. of dry matter as compared with about 12 per cent. in swedes, 13 per cent. in carrots, and 25 per cent. in potatoes. The dry matter of parsnips differs from that of swedes and carrots in containing an appreciable proportion of starch, thus resembling the potato. The food value of parsnips is about three-fourths that of potatoes. Since, therefore, difficulty may be experienced in obtaining sufficient "seed" potatoes during the coming spring, parsnips might well be grown as a partial substitute.

An average crop of parsnips will yield at least 10 to 12 tons per acre (140 lb. to 168 lb. per rod of $30\frac{1}{4}$ sq. yd.) At the present time parsnips are worth about £8 per ton, but the normal run of prices is much lower. Surplus supplies will furnish excellent feeding material for pigs, for which purpose they may be used, when available, to eke out small potatoes.

Varieties.—The modern parsnip is a cultivated form of the Wild Parsnip (*Peucedanum sativum*) often found in hedgerows and on roadsides, especially on chalky soils. There are several cultivated forms, of which the following are the chief: (1) The "Student" parsnip, with a long root and slightly concave crown; (2) the "Hollow Crown" with thicker root at the top and deeper hollow crown; and (3) a Turnip-rooted form. For rich land the Student is, perhaps, the best variety, but for general purposes the Hollow Crown type is the most suitable. Of the latter variety several types have been brought out by different seedsmen. As the seed does not retain its vitality long, care should be exercised in purchasing. Even two-year-old seed is very unreliable.

* This article is a reprint of Special Leaflet No. 70, copies of which will, therefore, not be sent to subscribers to the *Journal*.

Soil and its Preparation.—The parsnip is best adapted to rich, sandy soils such as are found in the principal market-gardening districts. On such land it is relatively easily dealt with on a large scale, but where the labour and expense of lifting need not be considered, parsnips may be grown successfully on nearly any kind of soil, from light sand to heavy clay, provided it is well cultivated. The extremes, whether of light or of heavy soils, are the least suitable. (As a rule parsnips will answer better than potatoes on heavy soils.) There need be no hesitation in sowing parsnips on recently broken grass land provided the soil has been turned over to the depth of about a foot and the subsoil well stirred.

On a field scale the land is usually ploughed as deeply as possible in autumn, cultivated once or twice before mid-February, and then harrowed till a fine seed-bed is obtained. On the heavier class of soils late cross-ploughing is rarely an advantage. A deep fine tilth lessens the risk of curving and "forking" of the roots. As, however, the bulk of the root of the Hollow Crown varieties is formed in the first foot of soil, "forking," deeper down is not of much consequence.

Manuring. –Parsnips come best after a crop that has been heavily dressed with farmyard manure; as a rule, no dung should be applied directly to the crop or "forking" may result, but if the soil is poor, about 15 tons of dung per acre (2 cwt. per rod), applied in autumn, and dug, or ploughed in, will be an advantage. Parsnips grow over a long period, and, hence, the object of manuring should be to supply a sufficiency of fertilising material that will become gradually available throughout the season of growth. During the working of the land the following artificials, whichever are most readily obtainable, should be harrowed in:—

6 cwt. of superphosphate or 8 cwt. of basic slag per acre ($4\frac{1}{2}$ lb. and $5\frac{1}{2}$ lb. per rod, respectively), *or*

an equivalent in the form of a mixture of superphosphate and steamed bone flour, or superphosphate and ground mineral phosphate.

Just before sowing the seed, sulphate of ammonia at the rate of 1 cwt. per acre ($\frac{3}{4}$ lb. per rod) should be worked into the top soil, and, after singling, a further dressing of sulphate of ammonia, at the same rate, should be applied between the rows.

In the case of recently broken grass land, or land previously well dressed with dung, 15 to 20 cwt. per acre (11 to 15 lb. per rod) of lime should be worked into the ground when cultivating.

Rate and Method of Sowing.—Parsnips should be sown as early in the year as the condition of the soil will permit, usually from about the middle of February to the second week in March. Seed is usually drilled at the rate of 6 to 7 lb. of seed per acre (1 oz. per rod, or, say, 200 feet of drill), in rows 15 in. to 18 in. apart, and about 1 in. deep and lightly covered. If the seed is known to be of satisfactory germinating power, it may be economised by mixing with sand or similar material, or, in the case of small areas, three or four seeds may be dropped together at intervals of about 8 in. along the row. When grown as a farm crop it is often desirable to mix parsnip seed with a small quantity of grain, which serves to indicate the rows and assists in cleaning where necessary. When the plants show the "true" leaf as well as the "seed leaf," usually about a month from sowing, they should be thinned out to about 6 to 8 in. apart. (This is usually done by bunching with the hoe and afterwards singling by hand.) The soil between the rows should be stirred several times in the course of the summer.

Lifting.—When grown on a field scale parsnips may be harvested towards the end of October. Lifting is usually done with a fork, care being taken not to injure the roots. The tops are then cut off close to the crown and the roots clamped in heaps 2½ to 3 ft. wide and from 6 to 8 yd. long, or in small round heaps. The heaps are covered with straw and then earthed half way up; after a short interval the earthing up is completed. The more popular, and perhaps preferable, method is to leave the roots in the ground and lift them as required. A slight frost is believed to improve the flavour, and even a prolonged frost appears to do little, if any, damage. The remainder of the crop should be cleared off and clamped in a cool place before top growth begins, usually in February. A suitable site for a clamp is under a north wall or on a northerly slope.

Cooking.—The full food value of parsnips is obtained only when they are boiled whole, till quite soft. Cut up and served with butter or dripping, salt and pepper, they make a most wholesome dish. They are also excellent for flavouring soup and stews, and for making vegetable pies, etc. In various parts of the Continent salt fish and parsnips are a favoured dish.

Cultivation of Medicinal Plants.

IMMEDIATELY on the outbreak of War an article appeared in this *Journal* (September, 1914) dealing with the cultivation of medicinal plants in Great Britain. It was at that time believed that, since medicinal plants had been largely imported to a very considerable extent from enemy countries, a shortage of the more important drugs was liable to occur in Great Britain. Prices rose rapidly on the outbreak of war, and, as an example, it may be said that Belladonna root, which was worth 45*s.* per cwt. in January, 1914, sold for 65*s.* in June, 1914, rose to 100*s.* by August, 1914, and at present realises several times that price.

During the past two years much has been done to increase the home supply of drug plants, and it may now be said that, with the exception of four essential species, there need be no anxiety as to our supply of drug-yielding herbs. Indeed, as will be pointed out below, the four species referred to are likely to be put on the market in sufficient quantity to meet all home demands.

The Board have given the whole subject careful consideration, and have consulted the National Health Insurance Commission (England), and a recent communication from the Commission to the Board brings out certain important facts, and is printed below with the concurrence of the Commission.

" The question [of medicinal plants] has been widely discussed in the public Press, in which statements have been made which may have the effect of misleading the public in attaching an undue value to the production of plants which are of small medicinal or commercial importance, and it seems desirable that consideration should be given to the subject with a view to determine the following questions, namely:—

(1) What home-grown plants are of essential medicinal importance?

(2) What quantities of such plants are required?

(3) What steps should be taken to encourage the production of such plants in the quantities required?

(1) Although many home-grown plants are used in the treatment of disease, only four can, in the opinion of this Department, be regarded, from a medical point of view, as really essential—namely, Belladonna, Henbane, Digitalis, and Colchicum.

These plants are of great value in the treatment of disease, and, in the view of this Department, it is important that the home production of the plants should be increased to such an extent as to render this country self-supporting, at all events as regards the quantities required for home consumption.

(2) As regards the quantities of these four plants that are required, it is impossible to make a precise statement, but from

inquiries that have been made by this Department it appears that the quantity of Belladonna required for home consumption only may be estimated, approximately, as equivalent to about 50 tons of the dried leaves and about 50 tons of the dried root annually. The quantity of Henbane and Digitalis required is probably equivalent to about 20–25 tons of the dried leaves of each plant annually, while the quantity of Colchicum required appears to be considerably less. These estimates relate to home consumption only; in addition, much larger quantities are needed for the manufacture of medicinal preparations for export.

(3) It appears that there is sufficient Digitalis and Colchicum growing wild in this country to meet home requirements, and that it is unnecessary to set aside land for the cultivation of these plants. A considerable proportion of the home demand for Belladonna and Henbane could also be met by the collection of wild plants, but the demand could only fully be met by skilled cultivation. It would seem, therefore, that as regards Digitalis and Colchicum, and to a certain extent Belladonna and Henbane, much could be done to provide the quantities needed for home consumption by the dissemination of information as to the most suitable methods for collection, the encouragement of co-operation between associations of collectors and wholesale drug merchants, and by the encouragement of the provision of drying facilities. As the successful cultivation of Belladonna and Henbane requires skill and experience, it is doubtful whether a large quantity could be produced by small cultivators without organisation and skilled supervision, but the acreage under cultivation by the larger cultivators has considerably increased since the outbreak of war, and it is probable that it now suffices, together with what could be obtained from the collection of wild plants, for home requirements."

Notes on Feeding Stuffs in February: *From the Animal Nutrition Institute, Cambridge University.*

DURING the last month the alterations which have taken place in the prices of feeding stuffs are most irregular. The most striking changes are the drop of about 6*d.* per unit in the cost of cotton seed, of 5¾*d.* in maple peas, and 3½*d.* in dun peas and linseed oil; and the rise of 4*d.* in brewers' grains. The other changes which have taken place are comparatively small—1*d.* to 2*d.* per unit—sometimes a rise, sometimes a fall. On the whole, the average cost to the farmer of his feeding stuffs is slightly higher than last month.

Since last month the Food Controller has put the housewives of the Nation on their honour to save a million tons of food, and his appeal has been emphatically endorsed by the Prime Minister. Farmers should note that Lord Devonport lays special stress on the saving of bread. This can only mean *that difficulties are foreseen in maintaining the importation of* cereals for human food.

If there are such difficulties in providing cereals for human food it is unlikely that any large quantity of cereals will be available for feeding stock.

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate Prices per ton at the end of January. London.	Liverpool.	Hull.	Bristol.	Glasgow.	Leith.
		£ s. d.	£ s. d	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soya Bean Cake	122·3	17 10 0	—	17 10 0	18 0 0	—	—
Decorticated Cotton Cake ...	126·3	—	17 10 0	—	18 0 0	—	18 0 0
American Linseed Cake ...	119·0	—	—	—	—	—	—
Indian Linseed Cake	123·1	—	17 15 0	—	—	18 5 0	18 0 0
Russian Linseed Cake ...	133·5	—	—	—	—	—	—
English Linseed Cake... ...	120·1	19 10 0	18 10 0	17 10 0	19 7 6	18 10 0	18 5 0
Bombay Cotton Cake	65·3	—	15 5 0	14 10 0	—	—	14 17 6
Egyptian Cotton Cake ...	71·9	15 15 0	15 15 0	15 0 0	15 17 6	16 15 0	15 5 0
Coconut Cake	102·0	16 1 3	—	—	17 0 0	—	—
Palm Kernel Cake	96·1	16 0 0	15 0 0	—	15 10 0	—	‡13 10 0
Palm Kernel Meal (extracted)	94·5	—	—	—	—	—	—
Ground-nut Cake	145·2	19 1 3	—	16 10 0	18 15 0	18 0 0	—
English Beans	99·5	17 5 3	19 12 0	17 3 2	16 16 10	—	—
Bean Meal	99·5	—	—	—	—	18 5 0	—
Chinese Beans	101·2	16 16 0	17 0 8	—	—	—	—
English Maple Peas	97·2	19 2 3	—	20 0 0	—	—	—
English Dun Peas	97·2	17 15 7	—	17 15 7	—	—	—
Calcutta White Peas	97·5	—	—	*18 17 9*	—	—	—
American Maize	93·8	16 6 8	16 6 8	16 4 4	—	} 17 0 0	17 0 0
Argentine Maize	94·2	16 6 8	15 15 6	16 3 2	16 2 0	}	
Maize Meal	86·5	17 0 0	17 5 0	17 7 6	17 0 0	17 10 0	17 15 0
Maize Gluten Feed	121·0	16 12 6	16 7 6	—	16 10 0	—	—
Maize Germ Meal	99·2	16 17 6	16 5 0	17 0 0	17 0 0	—	—
English Feeding Barley ...	83·0	19 0 10	—	17 7 2	—	—	—
English Oats	75·4	*17 10 0 +18 3 4	17 12 7	17 6 8	17 6 8	} *16 10 0*	*16 0 0*
Argentine Oats...	75·4	17 17 4	—	—	—	}	
Malt Culms	69·9	11 10 0	14 0 0	10 0 0	11 15 0	12 10 0	13 0 0
Brewers' Grains (dried) ...	84·5	15 0 0	14 10 0	13 10 0	14 15 0	13 17 6	13 10 0
Brewers' Grains (wet) ...	21·1	2 8 0	—	1 15 0	—	—	1 15 0
Distillers' Grains (English)...	101·2	15 7 6	13 10 0	—	15 5 0	} 14 0 0	13 17 6
Distillers' Grains (French ...	101·2	15 7 6	—	—	—	}	
Distillery Mixed Grains (wet)	20·0	—	—	—	—	—	2 0 0
Egyptian Rice Meal	78·7	—	—	—	—	} 16 12 6	—
Burmese Rice Meal	78·7	—	*15 15 0*	—	—	}	
Wheat Middlings (coarse) ...	94·8	15 0 0	—	—	—	17 0 0	15 10 0
Wheat Sharps	90·5	15 5 0	16 0 0	14 15 0	16 0 0	15 7 6	14 10 0
Wheat Pollards...	96·7	—	14 15 0	—	—	—	—
Wheat Bran	77·5	*14 10 0*	*16 5 0*	*14 5 0*	*15 0 0*	*15 5 0*	*14 0 0*
Wheat Bran (broad)	79·9	15 10 0	—	15 15 0	15 10 0	15 15 0	15 0 0
Feeding Treacle	60·0	13 10 0	15 15 0	15 0 0	—	16 0 0	15 15 0
Linseed	153·5	29 0 0	30 0 0	28 10 9	29 9 7	—	25 10 0
Linseed Oil	250·0	48 10 0	§56 0 0	45 0 0	5s. gal.	—	—
Egyptian Cotton Seed... ...	108·6	—	—	17 10 0	—	—	—
Bombay Cotton Seed	99·6	—	—	—	—	—	—
Cotton Seed Oil	250·0	51 0 0	§60 0 0	—	—	—	—
Fish Meal	145·0	—	—	—	—	14 0 0	15 0 0
Locust Bean Meal	80·0	—	—	—	—	—	—

* Damp, + Dry } London. ‡ Carriage paid on 2-ton lots to any station. § In barrels.

With this in view farmers may confidently anticipate a further decrease in cereals and cereal products for stock-feeding, for which they should prepare as quickly as possible.

will be further decreased, there does not appear to be any immediate indication of a further decrease in the supply of oil cakes.

In these circumstances farmers will be well advised to devote the finer grades of wheat offals to the rearing of calves and the weaning of young pigs, and, in view of the present shortage of oats, to reserve the coarser offals and bran for their horses. The various kinds of oil cakes must suffice for the production of beef, mutton and milk. This leaves little or no meal for the pigs. To meet this deficiency, farmers must revise their methods of pig feeding. Suggestions as to this are given below.

Horses.—The rations suggested in these "Notes" for December and January will still be useful :—

I.—7 lb. Dried brewers' or distillers' grains.	II.—3 lb. Dried grains.
2 lb. Maize gluten feed.	4 lb. Maize.
1 lb. Linseed cake.	1 lb. Maize gluten feed
	1 lb Linseed cake.

These rations contain rather more protein and rather less carbohydrate than the ordinary ration of 12 lb. of oats, which they are designed to replace. This is most readily and cheaply corrected by giving each horse about a stone of pulped roots per day mixed with the chaff.

The following mixture will be found suitable for nag horses or ponies at town work, and its use will decrease the consumption of oats to one quarter :—

Distillers' or brewers' dried grains	1 part.
Maize gluten feed	1 ,,
Pollards or sharps	1 ,,
Oats	1 ,,

Such a mixture has about the same feeding value as oats, and may be used to replace oats weight for weight.

In-foal mares should still get their normal ration of oats.

Cattle Fattening for Beef.—By far the cheapest and most patriotic method of beef production is to use a liberal allowance of roots and straw, supplemented with not more than 3 rising *to 4 lb. of ground nut cake or decorticated cotton cake.* This will produce the greatest possible amount of beef with the lowest possible expenditure of imported food, especially if fattening is stopped as soon as the cattle are rather more than half fat. There is no doubt that this policy will pay the farmer and produce the most food for the Nation. (See also p. 1051.)

TABLE II.—LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	2	3¼	Coconut cake	3	1½
Ground nut cake ..	2	7½	Wheat middlings ..	3	2
Maize gluten feed ..	2	8¾	English linseed cake ..	3	2¾
Soya bean cake	2	10½	Malt culms	3	3½

	s.	d.		s.	d.
Maize germ meal ..	3	4½	Linseed oil	3	10½
Wheat sharps	3	4½	English maple peas ..	3	11
Argentine maize ..	3	5½	Maize meal	3	11¼
American maize	3	5¾	Cotton seed oil	4	1
English beans	3	6	Egyptian cotton cake ..	4	4½
Brewers' grains (dried) ..	3	6½	Feeding treacle	4	6
English dun peas	3	8	English feeding barley ..	4	7
Wheat bran	3	8¾	English oats	4	8½
Linseed	3	9¼	Argentine oats	4	8¾
Wheat bran (broad) ..	3	10½			

TABLE III.—LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Distillers' grains (English)	2	8	Linseed	3	11
Maize gluten feed ..	2	8½	English beans	3	11¼
Decorticated cotton cake	2	9¼	Maize meal	4	0
Indian linseed cake ..	2	10½	Burmese rice meal ..	4	0
English linseed cake ..	3	1	Malt culms	4	0¼
Wheat pollards	3	1¼	Wheat bran	4	2½
Palm kernel cake ..	3	1½	Egyptian cotton cake ..	4	4½
Maize germ meal ..	3	3¼	Linseed oil	4	6
Argentine maize	3	4	Bombay cotton cake ..	4	8
Chinese beans	3	4½	English oats	4	8
Brewers' grains (dried) ..	3	5¼	Cotton seed oil	4	10
American maize	3	5¼	Feeding treacle	5	3
Wheat sharps	3	6½			

TABLE IV.—HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	English dun peas ..	3	8
Ground nut cake ..	2	3¼	Wheat bran	3	8¼
Soya bean cake	2	10¼	Linseed	3	8½
Malt culms	2	10½	Calcutta white peas ..	3	10¼
English linseed cake ..	2	11	Wheat bran (broad) ..	3	11¼
Brewers' grains (dried) ..	3	2¼	Maize meal	4	0¼
Egyptian cotton cake ..	3	2½	English maple peas ..	4	1½
Wheat sharps	3	3	English feeding barley ..	4	2
Maize germ meal ..	3	5	Egyptian cotton seed ..	4	2¼
Argentine maize	3	5¼	Bombay cotton cake ..	4	5¼
American maize	3	5½	English oats	4	7
English beans	3	5½	Feeding treacle	5	0
Linseed oil	3	7¼			

TABLE V.—BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Ground nut cake ..	2	7	Maize germ meal ..	3	5
Maize gluten feed ..	2	8¾	Argentine maize ..	3	5
Decorticated cotton cake	2	10	Brewers' grains (dried) ..	3	5
Soya bean cake	2	11¼	Wheat sharps	3	6¾
Distillers' grains (English)	3	0¼	Linseed	3	10½
English linseed cake ..	3	2½	Wheat bran	3	10
Palm kernel cake ..	[illegible]	[illegible]	Wheat bran (broad)	[illegible]	[illegible]

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

LONDON, LIVERPOOL, HULL AND BRISTOL.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	11¾	Argentine maize.. ..	3	5
Ground nut cake ..	2	6	American maize.. ..	3	5¾
Maize gluten feed ..	2	8¾	English beans	3	6¾
Decorticated cotton cake	2	9½	English dun peas ..	3	8
Indian linseed cake ..	2	10½	Linseed	3	9¾
Soya bean cake	2	10½	Calcutta white peas ..	3	10¼
Distillers' grains (English)	2	11	Wheat bran	3	10½
Distillers' grains (French)	3	0½	Wheat bran (broad) ..	3	10¾
English linseed cake ..	3	1¼	Maize meal	3	11¾
Wheat pollards	3	1¼	English maple peas ..	3	11¾
Wheat middlings ..	3	2	Burmese rice meal ..	4	0
Coconut cake	3	2½	*Linseed oil*	4	0
Palm kernel cake ..	3	2½	Egyptian cotton cake ..	4	4
Egyptian cotton seed ..	3	2½	English feeding barley ..	4	4½
Chinese beans	3	4¼	Cotton seed oil	4	5½
Maize germ meal ..	3	4½	Bombay cotton cake ..	4	6½
Malt culms	3	4¾	English oats	4	8
Wheat sharps	3	5	Argentine oats	4	8¾
Brewers' grains (dried)..	3	5	Feeding treacle	4	11

TABLE VII.

GLASGOW. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Fish meal	1	10	Maize	3	7½
Ground nut cake ..	2	5¾	Bean meal	3	8¼
Distillery mixed grains (dried)..	2	9¼	Wheat bran	3	11¼
Indian linseed cake ..	2	11¾	Wheat bran (broad) ..	3	11½
English linseed cake ..	3	1	Maize meal	4	0½
Brewers' grains (dried) ..	3	3¼	Rice meal	4	2¾
Wheat sharps	3	4¾	Oats	4	4½
Malt culms	3	7	Egyptian cotton cake ..	4	8
Wheat middlings ..	3	7	Feeding treacle	5	4

TABLE VIII.

LEITH. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Wheat middlings ..	3	3¼
Distillery mixed grains (wet)	2	0	Linseed	3	4
Fish meal	2	1	Wheat bran	3	7¼
Distillery mixed grains (dried)	2	8¾	*Maize*	3	7½
Palm kernel cake ..	2	9¾	Malt culms	3	8¾
Decorticated cotton cake	2	10	Wheat bran (broad) ..	3	9
Indian linseed cake ..	2	11¼	Maize meal	4	1¼
English linseed cake ..	3	0½	Egyptian cotton cake ..	4	3
Brewers' grains (dried) ..	3	2½	Oats	4	3
			Bombay cotton cake ..	4	6½
			Feeding treacle	5	3

TABLE IX.

AVERAGE PRICES PER FOOD UNIT.

GLASGOW AND LEITH.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Linseed	3	4
Distillery mixed grains (wet)	2	0	Wheat middlings ..	3	5
Fish meal..	2	1	*Maize*	3	7½
Ground nut cake ..	2	5¾	Malt culms	3	8
Distillery mixed grains (dried)	2	9	Bean meal	3	8¼
Palm kernel cake ..	2	9¾	Wheat bran	3	9¼
Decorticated cotton cake	2	10	Wheat bran (broad) ..	3	10¼
Indian linseed cake ..	2	11½	*Maize meal*	4	0¾
English linseed cake ..	3	0¾	Rice meal	4	2¾
Brewers' grains (dried) ..	3	3	Oats	4	3¾
Wheat sharps	3	3½	Egyptian cotton cake ..	4	5½
			Bombay cotton cake ..	4	6½
			Feeding treacle	5	3½

Sheep Fattening on Roots.—A similar policy should be adopted, namely, a low cake ration, and as many roots as the sheep will eat.

Young Stock.—*Ewes with lambs.*—As last month, viz.:—

Linseed cake	2 parts.	Malt culms	1 part.
Dried grains	1 part.	Beans	2 parts.

Used as follows: For ewes with single lambs, ¾ lb. per ewe, rising to 1 lb.; the lambs, as soon as they eat well, should get 2 oz. per head through creeps, and as their ration is increased up to 1 lb. the ewe's ration should be reduced. For ewes with double lambs the ration should be ¼ lb. greater until the lambs begin to eat; as soon as a separate feed is put through creeps for the lambs they should get 2 oz. per head, and as this is increased the ewe's ration should be reduced.

Pigs.—The prospective further decrease in the supply of suitable meals will compel farmers to adopt new methods of pig feeding. The following suggestions are confidently recommended: For weaning young pigs from 6 to 10 weeks old the finer grades of wheat offals are necessary, but the amount required per head can be cut down to a stone or a little more. At 10 weeks, or soon after, the pigs can be gradually got on to pulped roots and some fairly nitrogenous meal, such as maize gluten feed, palm kernel meal, bean meal, or finely-ground linseed cake. These foods should be mixed in the proportion of 3 bush. of pulped roots to a stone of the meal; and this diet will bring the pigs to the butcher in reasonable time. This method of feeding will yield about twice as much pork or bacon per stone of imported food as the usual method of using all meal. The roots required can be set free by shortening the fatting period of the bullocks.

As the season advances, the feeding should be modified as follows: The young pigs should still be weaned on wheat offals. At 10 weeks old, or thereabouts, they should be turned out to grass with a pound or so of meal per head per day for the first fortnight. For the next 5 months, while on grass, they should get about ½ lb. per head per day of coconut cake, palm kernel cake, maize gluten feed, beans or peas. At the end of this period they should weigh about 140 lb. They may be made into fat hogs, weighing about 240 lb., by the use of about 4½ cwt. of meal. This method will give 1 lb. of live pig by the use of about 3 lb. of imported food, instead of the usual 5 or 6 lb. Unless such methods are adopted the supply of home-grown pork and bacon must be seriously diminished.

TABLE X.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Per cent. digestible				
Name of Feeding Stuff.	Nutritive Ratio.	Protein.	Fat.	Carbo-hydrates and Fibre.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0.8	45.2	6.3	21.1	77.5	102
Soya bean cake	1 : 1.1	34.0	6.5	21.0	66.7	88
Decort. cotton cake ..	1 : 1.2	34.0	8.5	20.0	71.0	93
Linseed cake, Indian ..	1 : 1.9	27.8	9.3	30.1	77.1	101
Linseed cake, English ..	1 : 2.0	26.7	9.3	30.1	76.0	100
Cotton cake, Egyptian ..	1 : 2.1	15.5	5.3	20.0	40.0	53
Cotton cake, Bombay ..	1 : 2.5	13.1	4.4	21.5	37.6	49
Distillers' grains (English).. Distillers' grains (French)	1 : 2.9	18.7	10.2	29.0	57.3	75
Maize gluten feed	1 : 3.0	20.4	8.8	48.4	87.4	115
Brewers' grains, dried ..	1 : 3.5	14.1	6.6	32.7	50.3	66
Coconut cake	1 : 3.8	16.3	8.2	41.4	76.5	101
Palm kernel cake	1 : 4.5	14.1	6.1	48.9	76.7	101
Linseed	1 : 5.9	18.1	34.7	20.1	119.2	157
Bombay cotton seed ..	1 : 6.6	11.0	16.8	30.1	77.5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8.5	9.0	6.2	61.2	81.0	107
Rice meal	1 : 9.4	6.8	10.2	38.2	68.4	90
Rich in Protein, Poor in Oil.						
Fish meal	1 : 0.1	54.0	4.0	—	60.0	78
Peas, Calcutta white ..	1 : 2.1	23.3	1.1	45.9	66.9	88
Beans, English	1 : 2.6	19.3	1.2	48.2	67.0	88
Beans, Chinese	1 : 2.6	19.6	1.7	47.9	67.0	88
Peas, English maple ..	1 : 3.1	17.0	1.0	50.0	70.0	92
Palm-nut meal (extracted)	1 : 3.4	15.6	1.9	48.7	66.1	87
Brewers' grains, wet ..	1 : 3.5	3.5	1.5	8.6	12.7	17
Malt culms	1 : 3.6	11.4	1.1	38.6	38.7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8.0	8.0	2.1	57.8	67.9	89
Oats, English	1 : 8.0	7.2	4.0	47.4	59.7	79
Oats, Argentine	1 : 8.0	7.2	4.0	47.4	59.7	79
Maize, American	1 : 11.5	6.7	4.5	65.8	81.0	107
Maize, Argentine	1 : 11.3	6.8	4.5	65.8	83.5	110
Maize meal	1 : 13.0	5.5	3.5	63.9	77.8	102
Wheat middlings	1 : 4.8	12.8	4.1	52.5	73.1	96
Wheat sharps	1 : 5.1	11.6	3.4	51.6	62.0	80
Wheat pollards	1 : 4.5	13.6	3.7	52.5	62.1	82
Wheat bran	1 : 4.7	11.3	3.0	45.0	49.7	65
Wheat bran, broad ..	1 : 4.7	11.3	3.0	45.4	48.1	63
Locust bean meal ..	1 : 22.1	4.0	0.7	69.2	71.4	94

Notes on Manures in February: *From the Rothamsted Experimental Station.*

IN the present crisis the farmer's duty stands out with perfect clearness; he must produce and save every ounce of food he can. Prices are so high that he can afford to take the necessary steps, and the need is so great that he ought to take them apart from mere considerations of monetary return.

Spring Dressings.—Abundant evidence has shown that a supply of quick-acting nitrogenous manure is an indispensable condition to success in raising large crops. The present winter, whatever its faults, has not been wet, and the soil has not suffered the losses it did last year. There will, however, still be a strong case for the use of spring dressings for corn crops and for good dressings for roots and potatoes.

Practically the only quick-acting nitrogenous fertiliser available is sulphate of ammonia. This is not as rapid as nitrate of soda, and must, therefore, be applied earlier; hence the necessity for being ready with it.

Organic Manures.—Some of the organic manures deserve attention.

The probable retail prices of fish guano during February are given in the table on p. 1115 as 3*s.* 0½*d.* per unit of insoluble phosphate (with 20*s.* 7½*d.* allowed per unit of nitrogen) at Hull, and 4*s.* 0½*d.* per unit of insoluble phosphate (with 27*s.* 0½*d.* allowed per unit of nitrogen) at King's Lynn. At the price at Hull the fish guano is distinctly good value.

Meat and bone, containing nitrogen equivalent to 6 per cent. of ammonia and 22½ per cent. of phosphates, is expected to be rather dearer than the fish guano, assuming the phosphates are reckoned as having the same value (as we reasonably may).

Castor meal is also obtainable, containing nitrogen equivalent to 5½ to 7½ per cent. of ammonia, along with smaller quantities of phosphates (usually about 3 per cent.) and still smaller quantities of potash (about 1 per cent.) The prices during February are expected to be 23*s.* 9*d.* per unit of nitrogen at Hull, and 27*s.* 7½*d.* at King's Lynn (with 2*s.* allowed per unit of insoluble phosphates and 15*s.* per unit of potash in both cases). These prices are rather less for equal fertilising material than in the case of meat meal.

The great advantage of these organic fertilisers, when they are in a fine state of division, lies in the fact that they exert a very beneficial effect on the tilth of the soil. For root crops this is a very desirable property, inasmuch as the young plants may have some difficulty in becoming established if the tilth

is bad. Potato growers who have hitherto used London stable manure in large amounts, and now find that they cannot obtain deliveries of the bulk required, can replace some of this with suitable dressings of these organic manures.

Some of the organic manures periodically put on the market are very poor in fertilising constituents, containing less than 1 per cent. of nitrogen and only low amounts of phosphates. There is no evidence that any of them are worth more than a few shillings per ton, and at the present time, when labour and traction are both scarce, it is more than doubtful whether the farmer would be justified in touching them at all, unless they are cheaply and easily obtained. All manures should be bought *on a guaranteed analysis and valued on the basis of* the nitrogen, potash and phosphate present; there is no experimental evidence for assuming that any other constituents or properties are worth paying for.

Phosphatic Manures.—*In last month's "Notes" it was pointed* out that in present circumstances all the superphosphate should be reserved for arable land, and that the grass land should receive other phosphates, especially basic slag. In cases where ordinary superphosphate is not available in quantity the farmer is offered substitutes which it is hoped will answer satisfactorily. As these have not been tested in the field, it is difficult to pronounce a definite opinion either for or against them. The safest plan would appear to be to use sufficient true superphosphate on the root crops to ensure getting a good start, and, if need be, to use the substitute on the corn crops and to complete the dressing on the root crops.

	Weight of Hay per acre. 1911. cwt.	1912. cwt.	*Average.* cwt.
Plot 6.—6·6 cwt. Tunisian rock phosphate (ground), containing 59·99 per cent. phosphate of lime, trace citric soluble	26½	36¼	31½
,, 7.—No dressing	18¾	35	26¾
,, 8.—10·5 cwt. Belgian rock phosphate (calcined), containing 37·16 per cent. phosphate of lime, trace citric soluble	26¾	43¼	35
,, 1.—10·85 cwt. basic slag, containing 35·89 per cent. phosphate of lime, 95 per cent. citric soluble	24	41¼	32¾
,, 2.—9·1 cwt. basic slag, *containing 42·7 per cent.* phosphate of lime, 75 per cent. citric soluble	25½	42	33¾
,, 3.—9·75 cwt. basic slag, containing 39·97 per cent. phosphate of lime, 88·6 per cent. citric soluble	26½	40	33¼
,, 4.—4·55 cwt. basic slag, containing 42·7 per cent. phosphate of lime, 75 per cent. citric soluble, and 6·5 cwt. superphosphate, 29·87 per cent. soluble phosphate of lime (100 lb. phos. acid in each)	26¾	45¾	36¼
,, 5.—8·5 cwt. bone meal, containing 46·64 per cent. phosphate of lime, mostly citric soluble ..	28½	42½	35½

Plot.	Treatment.	1905. Turnips, Yield per acre.			1906. Barley Yields per acre. Grain.		1906. Barley Yields per acre. Straw.		1907. Hay Yields per acre.		Total Value of Three Crops.			Cost of Manures per acre.			Profit or Loss from the Use of the Manures.		
		tons	cwt.	lb.	bush.	lb.	cwt.	lb.	cwt.	lb.	£	s.	d.	£	s.	d.	£	s.	d.
1	Source of phosphate—Superphosphate ..	22	1	32	46	20	39	92	47	0	24	17	8	2	0	5	1	0	2
2	Source of phosphate—Basic slag ..	21	14	0	48	4	36	108	44	56	24	9	7	1	15	3	0	17	3
3	Source of phosphate—Bone meal ..	20	6	48	39	52	36	60	45	28	22	5	1	1	15	6	—1	7	6
4	Source of phosphate—Ground Florida phosphate	19	18	0	47	44	37	12	44	0	23	13	1	1	10	3	0	5	9
5	No manure..	16	18	48	45	44	38	12	41	0	21	17	1	—			—		
6	Source of phosphate—Dung and superphosphate	23	11	0	53	0	44	56	47	16	26	17	6	3	3	11	1	16	6
7	Source of phosphate—Dung and basic slag	23	6	0	50	44	41	68	47	0	26	2	11	3	1	4	1	4	6
8	Source of phosphate—Dung and bone meal	23	1	0	50	16	38	96	48	72	26	0	5	3	1	6	1	1	10
9	Source of phosphate—Dung and ground *Florida phosphate*	24	7	0	49	32	43	24	50	0	28	18	6	2	18	10	4	2	7

Some experiments have shown that finely-ground mineral phosphates act well on grass land in certain circumstances. Thus, in the Cockle Park trials,* the results shown on p. 1112 were obtained on a three years' ley.

The various phosphates were applied at sufficient rate to give 200 lb. of phosphoric acid per acre.

Other Northumberland experiments have also given good results, and there is a considerable body of Continental evidence to show that these phosphates are of good fertilising value. On the other side, however, must be set the Aberdeen experiments,† in which mineral phosphates were not found to act satisfactorily excepting when dung was used in addition. The Aberdeen results are given on p. 1113.

Further, it must be remembered that mineral phosphates have, from time to time, been put on the British market in competition with the usual fertilisers, but without making any great impression.

Farmers who are in a position to buy ground phosphates of this type and to get delivery should communicate with the County Authority to ascertain whether there is any evidence of suitability to their conditions.

In selling these phosphates it is usual to state the amount of total phosphate and also the amount soluble in citric acid. This latter figure usually needs to be interpreted by an agricultural chemist, as it can be made to vary by altering the conditions. Under the standard conditions prescribed by the Board, one set of results may be obtained, while under other conditions the result may be different. The safest plan is to consult the County Expert as to suitability before going to the expense of a purchase.

A satisfactory potash substitute has been brought to notice, containing a useful proportion of soluble potash. If the supplies turn out to be extensive they should prove of value to potato growers and others who need potash.

Unit Prices of Artificial Manures in February.—The statement on p. 1115 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for February, 1917.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures

* Cockle Park Expt. Station, Bull 19, 1913.

† Aberdeen and N. of Scot. Coll. of Agric., Bull. 10, 1909.

	England and Wales.										Scotland.	
	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.	Glasgow.	Leith.
Nitrogen from :	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sulphate of Ammonia pure 95 %	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	17 6	15 6
Sulphate of Ammonia pure 93 %	—	—	—	—	—	—	—	—	—	—	—	—
Calcium Cyanamide (Nitrolim)	19 4	—	—	—	—	—	—	—	—	20 0	—	—
Nitrate of Soda pure 95 %	—	27 3	26 3½	—	—	26 1½	26 3½	—	25 5	26 1½	27 1½	27 9
Nitrate of Soda pure 90 %	28 0	26 8	26 4	—	—	—	—	—	27 4	—	—	—
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—	—	—
Castor Meal..	—	27 7½	23 9	—	—	—	—	—	—	—	—	—
Allowed for Insol. Phos.	—	*2 0*	*2 0*	—	—	—	—	—	—	—	—	—
Allowed for Potash ..	—	*15 0*	*15 0*	—	—	—	—	—	—	—	—	—
Soluble Phosphates from :												
Superphosphate 35 %	3 4½	—	3 4½	4 0	3 7½	3 7	3 6	3 5	—	—	—	—
" 33 %	3 4	—	3 3	—	—	3 6½	3 6	3 5	—	—	—	—
" 30 %	3 4	—	3 4	3 10	3 8	3 7	3 6	3 5	—	—	4 2	—
" 26 %	3 8	—	3 8	4 3	4 0½	3 11½	3 10	3 9	—	—	—	—
Dissolved Bones.. ..	5 0½	—	4 10½	3 5½	4 11½	5 2½	5 2½	5 7½	5 6½	5 5	—	—
Allowed for Nitrogen	*19 11½*	—	*19 5½*	*13 8*	*19 8*	*20 7*	*20 6*	*22 3½*	*22 0*	*21 6*	—	—
Allowed for Insol. Phos.	*2 11½*	—	*2 10½*	*2 0½*	*2 11*	*3 1*	*3 0½*	*3 4*	*3 3½*	*3 2½*	—	—
Insoluble Phosphates (Citric Soluble) from :												
Basic Slag	2 9½	2 8	2 9	—	—	—	—	—	—	3 6½	—	3 3½
Insoluble Phosphates from :												
Basic Slag	—	—	2 3½	1 11½	—	2 1	—	—	—	2 9½	—	4 1
Bone Meal	2 4	—	2 7½	2 8	2 9½	2 11	2 11	2 10½	3 1	3 1½	—	15 6
Allowed for Nitrogen	*18 11½*	—	*17 8*	*18 0*	*18 9*	*19 8*	*19 8*	*19 2½*	*20 8*	*21 1*	—	3 1
Steamed Bone Flour..	2 7	2 8	2 10½	—	—	2 6	—	2 4½	2 7½	—	—	15 6
Allowed for Nitrogen	*17 3*	*17 10*	*19 6½*	—	—	*16 9*	—	*16 0*	*17 7*	—	—	—
Fish Guano..	—	4 0½	3 0½	—	—	—	—	—	—	—	—	—
Allowed for Nitrogen	—	*27 0½*	*20 7½*	—	—	—	—	—	—	—	—	—

mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating, and rebagging the ingredients, bags, and loss of weight.

Exports of Agricultural Produce in 1916, and Miscellaneous Agricultural Imports.*

THE imports of food into this country in 1916 were fully dealt with in this *Journal* for January, 1917, p. 955. It is proposed in the present note to deal briefly with agricultural exports in 1916, and with imports of agricultural produce other than food.

Feeding Stuffs.—The imports of oil seed cake and of oil seeds, from which feeding stuffs are produced as by-products, are shown in the following table. A comparison of the quantities in the two years 1913 and 1916 gives an index of the relative amounts of feeding stuffs available from imported oil seeds and cakes (imports of cereals were dealt with in the *Journal* for January):—

Description.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
			£	£
Cotton seed .. tons	615,332	329,237	4,648,617	4,449,933
Flax seed or linseed, qr.	3,274,062	2,507,086	7,195,399	9,357,636
Rape seed .. ,,	265,560	375,087	531,725	1,271,489
Soya beans .. tons	76,452	65,364	635,747	960,356
Nuts and kernels (for expressing oil) tons	81,120	373,018	1,933,052	8,532,032
Oil seed cake .. cwt.	406,700	283,937	2,539,892	3,115,955

Thus the supplies of oil-seed cake, soya beans, linseed and cotton seed have decreased since 1913 to an appreciable extent, a fact which has led to the comparatively high prices for feeding cakes from the seeds. Increases are, however, shown by rape seed, and nuts and

* The Accounts of goods imported include all articles of food, but do not include other goods which, at the time of importation, were the property of His Majesty's Government or the Governments of the Allies. The Accounts of goods exported include goods bought in the United Kingdom by, or on behalf of, the Governments of the Allies, but do not include goods taken from British Government stores and depots, or goods bought by His Majesty's Government and shipped on Government vessels.

kernels; the latter are not specified in the Board of Trade Monthly Accounts, but the increase must be mainly due to imports of palm-kernels and (to a smaller extent) of ground nuts and coconuts.

The home production of possible animal foods in the United Kingdom in 1916 is compared with that in 1913 in the following table:—

	1913.		*1916.*
	qr.		qr.
Wheat	7,087,050	..	7,471,884
Barley	8,204,066	..	6,612,550
Oats	20,660,279	..	21,333,782
Beans	950,309	..	892,572
	tons.		tons.
Potatoes	7,604,804	..	5,468,881
Turnips and swedes	25,313,818	..	23,318,170
Mangolds	9,276,129	..	9,009,752
Hay	15,395,088	..	15,197,872
	acres.		acres.
Grass not for Hay	24,055,440	..	24,305,071

The feeding of wheat has been restricted, but a comparison of the crops at the two dates gives an index of the relative amounts of offals available, if the increased milling percentage is taken into account. The live-stock feeder must remember that, with increasing pressure on human food supplies, the tendency will be to draw more and more on foods hitherto fed to animals (barley, oats, potatoes).

Manures.—The imports and exports of manures in 1916 are compared with those of 1913 in the two following tables:—

IMPORTS OF MANURES FOR HOME CONSUMPTION.

Kind.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	tons.	tons.	£	£
Basic slag	51,133	—	102,114	—
Bones, burnt and unburnt	40,685	27,405	219,637	243,376
Guano*	25,548	21,644	149,189	219,099
Nitrate of soda	140,926	20,896	1,490,669	361,619
Phosphate of lime and rock phosphate ..	539,016	333,371	874,166	838,605

* There is a small re-export.

EXPORTS OF MANURES MANUFACTURED IN THE UNITED KINGDOM.

Kind.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	tons.	tons.	£	£
Sulphate of ammonia ..	323,054	259,312	4,390,547	4,353,860
Superphosphates	63,480	14,527	166,314	74,420
Basic slag	165,100	38,628	261,972	104,059
Others	152,437	50,560	926,656	420,542
Total	704,071	363,027	5,745,489	4,952,881

As regards manures the main features are the stoppage of basic slag imports (to be offset against the decrease in exports), the much smaller quantities of nitrate of soda and phosphates imported, and the large quantities of sulphate of ammonia which were still being sent abroad in 1916. The production of sulphate of ammonia in the United Kingdom in 1914 was 432,618 tons (no later figures are available), so that a very considerable proportion of our home manufacture is normally exported. It is worth noticing that the nitrate of soda imports cost £10 11s. per ton in 1913, and £17 6s. in 1916.

Exports of Animals.—The chief items in the export trade from the agriculturists' point of view are those relating to live stock. These are compared with pre-war figures in the next table :—

EXPORTS OF ANIMALS.

Description.		Quantity. 1913.	Quantity. 1916.	Value. 1913.	Value. 1916.
ANIMALS, LIVING—FOR BREEDING :		Number.	Number.	£	£
Cattle	To United States of America	1,159	1,087	43,716	39,315
	,, Uruguay	178	163	17,620	17,089
	,, Argentine Republic	1,270	1,342	123,602	140,801
	,, Australia	53	40	6,116	3,377
	,, Canada	139	308	4,771	15,024
	,, Other Countries ..	1,745	877	78,472	59,414
	Total	4,544	3,817	274,297	275,020
Sheep and Lambs	To Germany	541	—	5,285	—
	,, United States of America	836	241	5,811	1,832
	,, Uruguay	676	240	7,926	5,130
	,, Argentine Republic	3,205	2,131	57,887	47,914
	,, Australia	173	56	4,099	719
	,, New Zealand ..	123	26	2,915	491
	,, Canada	424	407	2,902	3,934
	,, Other Countries ..	821	660	9,218	11,562
	Total	6,799	3,761	96,043	71,582
Swine	To Argentine Republic	313	10	4,729	212
	,, Canada	37	10	264	112
	,, Other Countries..	743	308	9,476	3,043
	Total	1,093	328	14,469	3,367
HORSES :	To Netherlands ..	18,940	20	129,628	2,475
	,, Belgium	34,835	—	483,695	—
	,, France	5,756	137	279,899	43,890
	,, Other Countries ..	9,101	1,560	889,093	390,734
	Total	68,632	1,717	1,782,315	437,099
ANIMALS OF OTHER KINDS— Not for food		41,251	43,023	62,744	44,205

Considering the present conditions, the exports of cattle have been well maintained, 1916 showing an increase compared with 1915 and 1914. The value has gone up from £60 per head in 1913 to £72 in 1916. The sheep exported are also above the numbers of 1915 and 1914, but are not much more than half those of 1913. The value rose from £14 per head in 1913 to £19 in 1916. With the practical cessation of the Dutch and Belgian trade, the exports of horses have dropped to a figure which is very low in comparison with pre-war times. The value increased from £26 per head in 1913 to £228 in 1916, as a result, principally, of the elimination of the less valuable animals formerly sent to Holland and Belgium.

Miscellaneous Imports and Exports.—The two concluding tables give particulars as to some miscellaneous agricultural imports and exports.

MISCELLANEOUS IMPORTS.

Description.	Quantity.		Value.	
	1913.	1916.	1913.	1916.
	cwt.	cwt.	£	£
Wood and timber ..	—	—	33,788,884	40,199,469
Tallow and stearine ..	1,984,673	998,059	3,375,072	2,302,584
Hides:				
Dry	622,889	600,358	2,688,467	3,351,975
Wet	831,323	770,329	3,159,832	4,132,000
Seeds, clover and grass	260,751	233,246	623,769	692,377
Flowers, fresh	—	—	288,728	180,346
	No.	No.		
Horses	11,899	1,213	460,702	106,638

MISCELLANEOUS EXPORTS.

Description.		1913.	1916.
Grain and flour	£	3,561,831	2 776,059
Meat (including animals for food)	£	1,238,907	1,242,294
Wool (sheep's or lamb's) ..	lb.	28,662,100	13,115,000
	£	1,807,645	1,355,830
Hides and undressed skins ..	£	1,886,305	1,528 460
Oil-seed cake	tons	53,448	5,552
	£	354,344	50,265
Agricultural machinery (prime movers except electrical)	£	1,360,954	163,325
,, (not prime movers or electrical)	£	1,628,232	250,481

Co-operation in the Disposal of Calves for Rearing.

ARISING out of correspondence between the Board and the Agricultural Organisation Society on the subject of bringing breeders and rearers of calves in touch with each other, two societies—one in Lancashire and one in Wiltshire—have initiated schemes under the auspices of the Agricultural Organisation Society to promote co-operation between farmers who have calves for disposal and those who require calves for rearing.

The Preston and District Farmers' Trading Society, Limited, will be pleased to receive orders for calves, both from farmers' co-operative societies and from individual farmers. Orders for calves can be placed for any number that is required, but as far as possible they should be ordered in lots of 6, 12, 18 or over, so as to obtain the lowest railway rates. The calves will be sent either carriage paid or carriage forward as preferred by the customer, and every care will be taken to send only good calves certified to be free from scour when put on rail. The Preston Society, however, will not be responsible for any loss which may occur after the calves have reached the railway station to which they are consigned. Terms are cash on delivery, and satisfactory references must be given by unknown customers. There are nearly 30 of the pedigree bulls subsidised by the Board of Agriculture and Fisheries in the district covered by the Preston Society. The Society will be pleased to arrange to supply calves guaranteed to be by these bulls on special terms. Inquiries and orders for calves should be addressed to Mr. John James, Trapp Farm, Carleton, Poulton-le-Fylde, who has been appointed by the Preston and District Farmers' Trading Society to manage this branch of the Society's business.

The Wiltshire Farmers, Limited, with headquarters at Chippenham, are also making arrangements on somewhat similar lines for the dispatch of calves to rearing districts. Persons interested should communicate with the Secretary of the Society at Chippenham.

OFFICIAL NOTICES AND CIRCULARS.

CULTIVATION OF LAND—LABOUR AND MACHINERY—POTATOES —WOMEN AND CHILDREN—MISCELLANEOUS.

CULTIVATION OF LAND.

THE following Circular was addressed by the Board, on 23rd January, to War Agricultural Committees in England and Wales :—

SIR,—

Executive Committees of War Agricultural Committees: Constitution and Powers.

1. I am directed by the President of the Board of Agriculture and Fisheries to inform you that a Regulation (2M)* has been made by Order in Council, under the Defence of the Realm Consolidation Act, 1914, conferring certain powers on the Board with the object of maintaining the food supply of the country.

2. Acting under this Regulation, the Board have made the accompanying Order,* with which the Regulation is embodied, delegating all the powers conferred on the Board to the War Agricultural Committees, who are required each to appoint an executive committee in the manner prescribed by Article 2 of the Order. This executive committee will be the body authorised to exercise on behalf, and at the expense, of the Board in each administrative county the powers conferred by Regulation 2M, and their action will not be subject to confirmation by the War Agricultural Committee.

3. The powers that are thus placed in the hands of the county executive committees are very wide and far reaching, but Mr. Prothero is confident that he can rely upon the committees to exercise them with a single eye to the national interests and with a due regard to the urgent necessity of economy in public expenditure. Mr. Prothero feels that any conditions which would involve constant reference to the Board must be avoided, in order that progress may be made with the least possible delay. The primary object which committees should keep before them is to see that farmers are assisted and encouraged to cultivate the existing arable land on their farms in such manner as will secure the greatest possible output of those crops which are most valuable in the national interest at the present time. There will, however, be some cases in which it is practicable and desirable in the national interest that grass land should be broken up, and the Regulation enables the committees to do this or to direct it to be done by the occupier, but they should satisfy themselves in each case that the change of cultivation is in the national interest, and they should not sanction the breaking up of meadow land or grass land which can more profitably be used as pasture. Schemes for the cultivation of derelict or waste land, which usually involve considerable capital expenditure, often with uncertain results, should not be undertaken without very careful consideration nor until the committee have satisfied themselves that any labour or machinery at their disposal cannot more profitably be applied to land which is already in cultivation. In view of the shortage of labour, etc., committees would be well advised, before undertaking to break up grass land or sanctioning such action, to consider whether it would not be more profitable to improve it as pasture.

* See p. 1128.

4. After these preliminary remarks, I am to make the following observations on various points of detail for the guidance and direction of the committees :—

5. *Constitution of Executive Committees.*—Each War Agricultural Committee should proceed at once to appoint not less than four and not more than seven of its members to be the executive committee, and that Committee should appoint a chairman. The names and addresses of the chairman and members should be sent to the Board. Mr. Prothero proposes in addition to appoint the District Commissioner of the Board to be a member of the executive committee, and he reserves the right to appoint other members. Pending the constitution of the executive committee, the existing executive committee of the War Agricultural Committee may act as the executive committee for the purposes of the Order. Not more than one executive committee may be appointed for each Administrative County.

6. *Sub-Committees.*—The executive committee may appoint such sub-committees as they think fit, which may, but need not necessarily include members of the executive committee, but the executive powers conferred by the Order cannot be delegated to sub-committees and can only be exercised by, or with the approval of, the executive committees. The executive committees will be able to decide in the light of their local knowledge as to the number and constitution of the sub-committees and the size of their districts, but Mr. Prothero hopes that an organisation will be set up which will keep the executive committee in touch with each parish or group of parishes in the county.

7. *Staff of Executive Committees.*—The Order authorises the executive committees to appoint such officers as they may consider necessary, subject to such directions as to approval of expenditure or otherwise as may from time to time be given by the Board. Mr. Prothero recognises that additional staff will be necessary, but he feels sure that the creation of new salaried posts will be restricted as much as possible and that full use will be made of any existing officers of the local authorities and of voluntary workers.

8. In the first place the executive committee should select and appoint a suitable executive officer, who should have a competent knowledge of agriculture and some administrative experience. In most cases it should be possible to obtain for this post the services of some member of the county staff, such as the Agricultural Organiser or the County Land Agent. Where this is the case the Board will be prepared, if the appointment is approved by them, to reimburse to the county council two-thirds of the normal salary and travelling expenses of such officer, but they are not prepared to sanction the payment of any additional salary to whole-time salaried officers of the county council who undertake work under the executive committees. If an executive committee is unable to obtain the services of a suitable officer from the county staff, the Board will be prepared to consider proposals for the appointment of a paid executive officer, not on that staff, but his name and particulars of his qualifications together with the salary proposed, which must not exceed £300 a year, should be submitted to the Board for their approval before any permanent appointment is made.

9. *Petty Expenses.*—Committees are authorised to incur necessary and reasonable expenditure on payments to surveyors, additional clerical assistance, travelling expenses, printing, stationery, postage and general

office expenses. With regard to travelling expenses it has been represented to the Board that the increase in the cost of railway travelling will throw a heavy burden of expense on the members of the executive committees, and the Board are prepared therefore to authorise committees to pay any of their members who apply for them their out-of-pocket travelling expenses in attending meetings of the committee, or when engaged on the work of the committee. Payments for travelling expenses should be on the basis of 3rd class railway fares or, if a member or officer of the committee uses his own motor car, at the rate of 7½*d.* a mile. An estimate of the probable expenditure of your committee under each of the above heads during the next three months, *i.e.*, to the 31st March next, should be sent to the Board as soon as possible.

10. *Executive Powers of Committees.*—The powers of the executive committees are set out in the Regulation, and Mr. Prothero desires me to make the following observations thereon for the guidance and direction of the committees.

11. *Power to Inspect Land, etc.*—It is hoped that in the great majority of cases no objection will be raised to the inspection of land or buildings on behalf of the executive committees in connection with any survey which they are undertaking of the land of the county, but to meet any case in which an owner or occupier refuses permission the executive committee are empowered by paragraph 5 of the Regulation to give the necessary authority, which might be in the following form:

> "The executive committee of the War
> "Agricultural Committee being the body authorised to exer-
> "cise on behalf of the Board of Agriculture and Fisheries
> "within the administrative county of the powers
> "in this behalf conferred by Regulation 2M of the Defence of
> "the Realm (Consolidation) Regulations, 1914, do hereby
> "authorise of
> "for the purposes of the said Regulation and upon production,
> "if so required, of this authority to enter on and inspect any
> "land or building in the said county and inspect any machinery,
> "implements of husbandry, farm stock or produce thereon.
>
> "By Order of the said executive committee.
>
> "Chairman of the said executive committee."

Obstruction of any officer or other person in the execution of his duty under the Regulation is an offence under Regulation 43 of the Defence of the Realm Regulations.

12. *Power to Waive Restrictive Covenants.*—It is probable that executive committees will receive a number of applications under paragraph 2 of the Regulation from occupiers of land for permission to cultivate their land in a manner not consistent with their contract of tenancy. The "scheme" referred to need not be of a formal character, but must sufficiently indicate the scope of the application. In such cases the committee should satisfy themselves that the permission of the owner has been asked and refused and should then arrange for the land to be inspected on behalf of the committee by a practical farmer together with a qualified local land agent, surveyor or valuer. Notice of the application should be given to the owner. If the committee decide to grant the application they should issue a direction that the land in question shall be cultivated in such specified manner as they think desirable in the national interest, and such direction, being obligatory, will

relieve the occupier from any penalty for breach of contract due to compliance with the committee's direction (5 Geo. V., ch. 37, sec. 1 (2)). Any question of compensation to be paid by the State to the owner for loss thus occasioned will be referred, in default of agreement, to the Defence of the Realm (Losses) Commission.

13. *Power to Issue Directions as to Cultivation.*—The Order empowers an executive committee under paragraph 1 (*e*) of the Regulation to serve a notice on the occupier of any land requiring him to cultivate the land in accordance with such requirements as they may think desirable for maintaining the food supply of the country. This power may be useful in cases where in the opinion of the committee an occupier is using his land for the production of crops which from the national point of view are unprofitable at the present time, or without good cause is cultivating his land inadequately. If an occupier negligently or wilfully fails to cultivate the land in accordance with any notice served by the committee he will be guilty of a summary offence against the Defence of the Realm Regulations.

14. *Power to Enter On and Cultivate Land.*—The Order and Regulation empower executive committees to enter on any land and cultivate it or adapt it for cultivation, and paragraph 4 of the Regulation provides for the recovery from the occupier of such amount as represents the value to him of the cultivation or adaptation for cultivation, the amount due being determined in default of agreement by arbitration under the Agricultural Holdings Act, 1908. It is eminently desirable that wherever possible any action taken by the executive committees should be on terms agreed with the occupier and that compulsory powers should only be used in the last resort. The cultivation must technically be that of the committee, but they may in some cases find it possible to employ the farmer as their agent for the purpose, and whenever it is possible they should arrange such terms with the occupier of the land as will recoup them for the cost. The actual payment of the amount due may, if the committee are satisfied that prompt payment cannot reasonably be insisted on, be deferred for such reasonable period as they think fit, for example, till the crop has been realised. The amount of assistance which committees can give in this direction will necessarily be limited by the labour and machinery at their disposal for the purpose, but every effort should be made to develop co-operation in the use of any labour and machinery at present available in any district so that it may be used to the fullest possible extent. In this connection the powers conferred by paragraph 1 (*b*) of the Regulation may be found useful.

15. *Power to Undertake Manuring.*—One of the most useful forms of action which committees can take in the public interest would be to arrange for the application of such fertilizers as sulphate of ammonia or basic slag in cases in which they are satisfied that this will be advantageous but in which the farmer from want of means or for some other reason cannot reasonably be expected to take such action on his own account. If a committee are of opinion that such an application would be advantageous they can arrange for the supply of the fertilizer to the tenant of the land and can employ him on their behalf to apply it in accordance with their directions. In such cases they may allow the tenant to defer payment for such period as they think reasonable, but it would be desirable, if possible, to obtain from him an undertaking to repay the cost to the committee not later than a certain date. Where

a tenant is not willing to come to such an arrangement a committee should not be deterred from exercising their powers of temporary entry for the purpose of applying the manure, and recovering the value in accordance with the Regulation, in any case in which they think this course to be in the national interest.

16. *Power to Take Possession of Land.*—Executive committees are empowered by the Order and Regulation to take possession of any land, with any machinery, implements, farm produce and stock, either on the land itself or on other land, and to farm the land themselves. This is a power which obviously should only be exercised in special cases, and where the Committee are satisfied not only that they can obtain the necessary labour, but also that the enterprise offers a reasonable probability of recouping the cost, and that it will result in a substantial increase in the food supply of the nation at an early date. There may, however, be cases in your county of farms which are grossly and wilfully neglected, and in such cases the executive committee should consider whether immediate action is desirable. The quickest and most satisfactory method will probably be to arrange with a neighbouring farmer to take over, on behalf of the committee, the management and supervision of the farm, or to instal a competent bailiff, but before taking definite action a careful estimate must be made of the amount of capital required to work the farm and a full report embodying the detailed proposals of the committee should be drawn up for consideration by the Board.

17. *Expenses.*—The exercise by an executive committee of the powers conferred by the Order and Regulation will, in many cases, involve considerable expenditure, apart from the administrative and office expenses of the committees which have already been dealt with in paragraphs 7 and 8 of this letter. Mr. Prothero realises that it is impossible at present for committees to submit any accurate estimates of the amount of money that they are likely to require, but at the same time he would not be justified in undertaking to give committees full authority to incur an unlimited liability for expenditure which the Board would have to defray. He thinks, therefore, that pending further directions the best course will be that committees should make their plans on the assumption that the necessary funds will be provided, but that they should inform the Board at the earliest possible date of any specific action which they propo e to take under the Order and Regulation, if it will involve substantial expenditure, and state the probable cost of the operations proposed, In order, however, to avoid unnecessary delay in matters which do not involve substantial expenditure, the Board are prepared to consider at once applications for imprests for specified sums, if particulars are given of the general purposes for which funds are required. It must be understood that expenditure can only be authorised in connection with work which the committees themselves undertake under the Order and Regulation.

18. *Control by the Board*—Mr. Prothero desires that the executive committees should be free to exercise their powers with as little departmental control as possible. It is clearly desirable in carrying out a policy which aims at promoting good farming and stimulating food production that the fullest use should be made of local knowledge and experience. But the committees will be acting as the agents and at the expense of the Board, and it is necessary that the Board should be fully informed of their proceedings. The Board direct, therefore, that

a report should be sent to them at the end of each week by the executive officer of each executive committee, which should contain information as to any action taken by the committee under the powers conferred on them by the Order, and should include a general account of the proceedings of the committee during the week. The Board direct also that if, in regard to any action which the committee propose to take, their District Commissioner informs the executive committee that in his opinion it should be referred to the Board for their approval, the executive committee shall so refer it and shall not proceed further till they have received the Board's approval. Pending further arrangements, the officer of the Board who has been acting as their local representative in connection with the work of the War Agricultural Committee of your county will act as the Board's District Commissioner, and I am to ask that he may be summoned to all meetings of the executive committee.

19. *General Observations.*—This letter deals only with the administrative machinery and powers of the executive committees. Mr. Prothero realises that the possibility of any effective action to increase food production on a large scale depends on many other considerations, such as the character of the season, and the provision of labour, implements, mechanical power, seeds, fertilisers and feeding stuffs. All of these are receiving his earnest and constant attention, and further communications in regard to them will be sent to you at the earliest possible date. But the Government cannot perform miracles, and the immediate task is to produce the best possible results from the existing conditions with the aid of the greatly increased powers which are conferred on the executive committees. The responsibility now rests upon them, and Mr. Prothero is confident that they will not fail to rise to the occasion and that every farmer in the country will support them by neglecting no means and sparing no effort to produce the maximum quantity of food for the nation.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

The Cultivation of Lands Order, 1917.

WHEREAS under Regulation 2M* of the Defence of the Realm (Consolidation) Regulations, 1914 (which was inserted in those Regulations by Order in Council, dated the tenth day of January, nineteen hundred and seventeen, and, so far as the same is applicable to England and Wales, is set out at the foot of this Order), the Board of Agriculture and Fisheries (hereinafter referred to as "the Board") are empowered, after such consultation with the Food Controller as may be arranged, to exercise certain powers with a view to maintaining the food supply of the country, and to authorise any person, or any body constituted by the Board for that purpose, to exercise on behalf of the Board the powers conferred on the Board by Regulation 2M, and to prescribe the procedure of any such body and the authentication of any notice or other instrument issued by any body so authorised.

And whereas the Board, after consultation with the Food Controller, are of opinion that for the purpose aforesaid such Order should be made as is herein contained;

* Printed below. See p. 1128.

Now the Board of Agriculture and Fisheries do hereby order as follows :—

1. The persons who are for the time being appointed by a county council of an administrative county to act as members of the War Agricultural Committee for the county are hereby constituted as the body to exercise in manner herein provided the powers conferred on the Board by Regulation 2M which are hereby authorised to be so exercised.

2. The body hereby constituted shall as soon as practicable appoint out of their members an executive committee consisting (1) of not less than four nor more than seven members unless the Board otherwise direct, and (2) of such additional members as the Board may appoint. In the case of a county in Wales (including Monmouthshire), two of the members so appointed by the body hereby constituted shall be the members representing the council of the county on the Welsh Agricultural Council. Until an executive committee is appointed under this provision, an executive committee of the War Agricultural Committee existing at the date of this Order may act as the executive committee for the purposes of this Order.

3. The body hereby constituted for a county, acting through the executive committee, may, on behalf and at the expense of the Board, but subject to such directions as to approval of expenditure or otherwise as may from time to time be given by the Board, exercise within the county any of the powers of the Board under Regulation 2M and appoint such officers and incur such expenses as the committee may consider necessary or expedient for such purposes. The rights of any person dealing with the committee shall not be affected by any question as to compliance by the committee with any directions so given by the Board to the committee.

4. An executive committee shall from time to time report their proceedings to the body constituted by this Order for the county, but the acts of the committee shall not be subject to confirmation by that body.

5. A member of an executive committee shall not take part in any decision of the committee which relates to land of which he is the owner or occupier, or the agent of the owner or occupier, or enter into any contract with the committee.

6. Separate accounts shall be kept by an executive committee of their receipts and expenditure under this Order and be open to inspection by any officer of the Board and those accounts shall be made up and audited in such manner as the Board shall direct.

7. An executive committee shall appoint a chairman of the committee. At any meeting at which the chairman is not present a person appointed by the meeting shall be entitled to act as chairman of the committee. At any meeting of an executive committee the chairman shall, in case of an equal division of votes, have a second or casting vote.

8. The quorum proceedings and place of meeting of an executive committee shall be such as the committee determine.

9. The proceedings of an executive committee shall not be invalidated by any vacancy among its members, or by any defect in the appointment or qualification of any of its members.

10. Minutes of the proceedings of an executive committee shall be kept in a book provided for that purpose and a minute of those proceedings signed at the same or the next ensuing meeting by a person

describing himself as, or appearing to be, chairman of the meeting at which the minute is signed shall be received in evidence without further proof.

11. Any notice, direction or other instrument signed by a person describing himself as or appearing to be chairman of an executive committee shall be received in evidence without further proof as a notice, direction or instrument issued by the executive committee.

12. Until the contrary is proved an executive committee shall be deemed to have been duly constituted.

13. An executive committee may, subject to any directions given by the Board, appoint such sub-committees as the committee thinks fit. A sub-committee may consist either wholly or partly of persons not being members of the executive committee.

14. This Order applies only to administrative counties in England and Wales.

15. This Order may be cited as the Cultivation of Lands Order, 1917.

In witness whereof the Board of Agriculture and Fisheries have hereunto set their Official Seal this nineteenth day of January, nineteen hundred and seventeen.

(L.S.) SYDNEY OLIVIER,
Secretary.

THE following Regulations under the Defence of the Realm Acts were published in the *London Gazette* of 12th January, 1917:—

Food Production Regulations.

Powers of the Board of Agriculture as to the Cultivation of Land.—" 2M.—(1) Where the Board of Agriculture and Fisheries, after such *consultation with the Food Controller* as may be arranged, are of opinion that, with a view to maintaining the food supply of the country, it is expedient that they should exercise the powers given to them under this regulation, the Board may—

(*a*) enter on and take possession of any land which in their opinion is not being so cultivated as to increase, as far as practicable, the food supply of the country, and, after entry thereon, do all things necessary or desirable for the cultivation of the land or for adapting it for cultivation ; and for such purposes enter on and take possession of any buildings on the land or convenient for such purposes ; and

(*b*) *take possession of any machinery or implements of husbandry* or farm produce or stock on the land, or which, in the opinion of the Board, are required for its cultivation ; and

(*c*) provide housing accommodation for persons employed for any such purposes by taking possession of any land or unoccupied premises and

(*d*) utilise any water supply or motive power for any such purposes ; and

(*e*) by notice served on the occupier of any land require him to cultivate the land in accordance with such requirements as the Board may think necessary or desirable for maintaining the food supply of the country and may prescribe in the notice.

Power to Alter Contract of Tenancy.—(2) An occupier of land may, with a view to maintaining the food supply of the country, submit to the Board a scheme for the cultivation of the land in a manner not

consistent with the contract of tenancy of the land, and the Board, if satisfied that the adoption of the scheme is necessary or desirable for the maintenance of the food supply, may direct that the land shall be cultivated in accordance with the scheme, subject to any modification which the Board may think fit to make therein.

(3) An occupier of land on whom a notice is served or to whom a direction is given by the Board under the preceding provisions who negligently or wilfully fails to cultivate the land therein referred to in accordance with the requirements of the notice or direction, shall be guilty of a summary offence against these regulations.

Compensation to the Board on Withdrawal.—(4) If the Board at any time withdraw from possession of any land of which possession has been taken under this regulation, they may recover from the person then entitled to resume occupation of the land such amount as represents the value to him of all acts of cultivation or adaptation for cultivation executed by the Board; such amount to be determined, in default of agreement, by a single arbitrator under and in accordance with the provisions of the Second Schedule to the Agricultural Holdings Act, 1908.

Powers of Entry and Inspection.—(5) Any person authorised by the Board in that behalf may, for the purposes of this regulation and upon production if so required of his authority, enter on and inspect any land or building and inspect any machinery, implements of husbandry, farm stock or produce thereon.

Delegation of Powers.—(6) The Board may with respect to any land or land in any district authorise any person or any body constituted by the Board for the purpose to exercise on behalf of the Board any of the powers of the Board under this regulation and prescribe the procedure of any such body, and the authentication of any notice or other instrument issued by any body or person so authorised.

(7) The powers conferred on the Board by this regulation shall be in addition to and not in derogation of any other powers of the Board.

(8) In this regulation the expression 'cultivation' includes use for grazing and the expression 'cultivate' has a corresponding meaning.

(9) This regulation shall apply to Scotland, with the substitution of the Board of Agriculture for Scotland for the Board of Agriculture and Fisheries, of arbiter for arbitrator, and of the Agricultural Holdings (Scotland) Act, 1908, for the Agricultural Holdings Act, 1908.

2N. If any person without lawful authority enters or remains on land of which a Government department or any body or person authorised by a Government department is in possession under the powers conferred by Regulation 2L or Regulation 2M, and on which notice of this provision is conspicuously displayed, or damages any crops growing on any such land, he shall be guilty of a summary offence against these regulations.

Permission to Keep Pigs, notwithstanding By-laws.—20. With a view to maintaining the stock of pigs in the country, any local authority by whom a by-law has been made which is for the time being in force prohibiting, restricting, or regulating the keeping of pigs may grant permission, either generally or in particular cases, to keep pigs, notwithstanding or contrary to any provisions of any such by-law; subject, however, to the observance of any directions of the local authority in the interests of public health.

Regulations Relating to Cultivation in Ireland.—2P. (1) Subject to the provisions of this regulation, it shall be the duty of every occupier of arable land in Ireland to cultivate in the year nineteen hundred and seventeen so much of the arable land held by him, and hereinafter called the 'holding,' as is specified in that behalf in this regulation, and if he fails or neglects to do so, he shall be guilty of a summary offence against these regulations.

(2) The portion of the holding to be cultivated pursuant to this regulation shall be as follows:—

(*a*) If no part of the holding was cultivated in the year nineteen hundred and sixteen, a portion equivalent in extent to one-tenth of the area of the holding;

(*b*) If any part of the holding was cultivated in the year nineteen hundred and sixteen, a portion equivalent in extent to the part so cultivated and to one-tenth of the area of the holding in addition: provided that the occupier shall not be required by virtue of this provision to cultivate more than one-half of the area of the holding.

(3) This regulation shall not apply to—

(*a*) Any holding of less than 10 acres in extent; or

(*b*) Any holding or class of holdings as to which not later than the twenty-fifth day of March nineteen hundred and seventeen it shall be declared in writing by the Department of Agriculture and Technical Instruction for Ireland that the cultivation of the holding or class of holdings would be of less service for the production of food than the use of the holding or class of holdings in some other manner in which the same is being used or proposed to be used.

(4) Land under a first or second year's crop of rye-grass shall be deemed to be cultivated, and cultivation by any person under a conacre letting made by the occupier shall be deemed to be cultivation by the occupier.

(5) This regulation shall have effect notwithstanding any covenant, agreement, condition, or provision as to the user of a holding whether contained in any lease or other instrument affecting the holding or in any verbal contract of tenancy or implied by law, and no such covenant, agreement, condition, or provision shall operate so as to penalise, impede, or interfere with such cultivation as is required by this regulation.

(6) Any person duly authorised by the Department of Agriculture and Technical Instruction for Ireland in that behalf shall have power to enter on and inspect any land for the purpose of ascertaining whether the requirements of this regulation are being or have been complied with.

(7) For the purpose of this regulation 'arable' means cultivated or capable of being cultivated; and 'occupier' means the person rated or liable to be rated to the poor rate, and in the case of a holding of which the half rent is rated means the actual occupier although not liable to be rated.

Killing of Deer in Scotland.—2Q. The Board of Agriculture for Scotland may, with the consent of the Secretary for Scotland, take or authorise such action in Scotland, whether by killing the deer or otherwise, as may, in their opinion, be necessary with a view to preventing or reducing injury to crops or wastage of pasturage caused by deer."

THE President of the Local Government Board and the President of the Board of Agriculture have addressed the following Circular Letter, dated 1st February, to the Lord Mayors, Mayors, and Chairmen of Local Authorities, with reference to the cultivation of land in urban areas under the Order of the Board of Agriculture:—

Urban Land Cultivation.

The Government consider it of the utmost importance that full effect should be given to the Order, but they realise this can only be done if there is a real driving power in each district. As a rule, this driving power must come from the local authority, and it is therefore desirable that, where satisfactory measures have not been adopted by voluntary organisations, the local authority should immediately take all necessary steps to secure a full cultivation of available land within their district. For this purpose it may be well to appoint a working committee which will inspire general confidence to carry the scheme into full execution.

A few points have been raised on which it may be desirable that the Government should express their views:—

1. *Co-operation of Women.*—It is essential for the success of the scheme to secure the active co-operation of women, in order that female labour should be utilised as fully as possible.

2. *Direct Cultivation of Land by Local Authorities.*—If a local authority, having possession of a piece of land suitable for the purposes of the Order, find that they cannot dispose of it to cultivators, and that it would be left idle unless cultivated by the Council themselves, we should not wish to offer objection to direct cultivation by the local authority, if they would thus be able to take advantage of spare labour which would not in any case be employed on food cultivation. The primary aim, however, of the policy of the Government is to promote the voluntary efforts of urban inhabitants to cultivate available lands in their spare time.

3. *Excess Expenditure by Local Authorities.*—The Board of Agriculture are not willing generally to increase their contribution beyond the £2 per acre already announced, but where it is shown to the satisfaction of that Department that a larger expenditure, not exceeding an additional £2 an acre was reasonably incurred, the grant will be increased so as to cover one half of that excess, and the Local Government Board will be prepared, in the case of a local authority whose accounts are subject to audit by a district auditor, to sanction, under the Local Authorities (Expenses) Act, 1887, the expenditure represented by the other half of the excess.

4. *Rates on Land Cultivated.*—The local authority are, under the Order, acting as the agents of the Board of Agriculture and Fisheries, and the land taken may be regarded as Crown land, and thus not subject to rates. The cultivators will not be in the position of ordinary tenants, but rather in that of users of the land by permission of the local authority for the express purpose of increasing the total food supply of the country, and, in these circumstances, we think they may be regarded as not liable for the payment of rates.

Home Production of Food; Advisory Committee and District Commissioners.

THE President of the Board of Agriculture and Fisheries has appointed a Committee of representative agriculturists to advise him on questions arising in connection with the increased production of food. The Committee is constituted as follows :—

The Right Hon. R. E. Prothero, M.P., *Chairman.*
The Right Hon. Sir Ailwyn E. Fellowes, K.C.V.O., *Vice-Chairman.*
The Right Hon. F. D. Acland, M.P.
The Right Hon. Henry Hobhouse.
The Hon. Edward G. Strutt.
Sir Sydney Olivier, K.C.M.G., Board of Agriculture.
Mr. W. W. Berry, Development Commissioner.
Mr. S. W. Farmer.
Mr. F. L. C. Floud, Board of Agriculture.
Mr. A. D. Hall, F.R.S., Development Commissioner.
Mr. S. Kidner.
Mr. T. H. Middleton, C.B., Board of Agriculture.
Mr. A. Moscrop.
Mr. H. Padwick, National Farmers' Union.
Mr. R. G. Paterson.
Mr. G. G. Rea.
Mr. E. Savill.
Mr. Leslie Scott, K.C., M.P.
Professor W. Somerville, M.A., Sc.D.

Mr. E. M. Konstam (who has joined the Department for the duration of the War) is the secretary of the Committee.

Effect will be given to the President's policy by a special division of the Board—the Department of Food Production—established by Mr. Prothero. Mr. T. H. Middleton has been appointed director of this Department. The assistant directors are Mr. F. L. C. Floud (in charge of the indoor staff), Mr. Sydney Mager (in charge of the outdoor staff), and Professor Bryner Jones, chairman of the Welsh Agricultural Council (in charge in Wales).

The extensive powers conferred on the Board under the Cultivation of Lands Order, 1917, have been delegated to county executive committees, to be set up by the War Agricultural Committees, and funds have been provided which will enable the executive bodies to undertake work without delay. The Department of Food Production will co-ordinate the work of the county committees, and will serve as a "clearing house" to which their wants will be reported and from which their requirements for labour, fertilisers, etc., will be met so far as this is practicable under present conditions. The immediate object is to assist farmers who are now making greatly increased efforts in preparing for the harvest of 1917; concurrently, plans are being prepared for organising increased production in 1918.

In order that the Department may be in close touch with the whole of the work of increasing the food supply, the country will be divided into districts; in each of these the Board will be represented by a District Commissioner, who will be *ex officio* a member of the County Executive Committees in his area.

All correspondence on the subject of increasing food production should be addressed, The Director, Food Production Department, Board of Agriculture and Fisheries, 72, Victoria Street, London, S.W.

WITH regard to the 1917 oat harvest the Secretary of the War Office has issued the following announcement explanatory of the Army Council's offer to contract at 41*s.* 3*d.* per qr. of 320 lb. and the fixing by the Food Controller of the price of oats for the same harvest at 38*s.* 6*d.* per 336 lb.

War Office Bonus for 1917 Oat Crop.

The Army Council's offer is strictly confined to oats from suitable land now in permanent pasture. The intention is to have a large increase in the arable area of the United Kingdom, to save cubic space in ships by growing oats here instead of purchasing them from abroad, to prevent the export of gold, and to produce more straw for forage purposes.

Those who accept the Army Council's offer must apply suitable artificial manures to a minimum value of 25*s.* per acre.

The bonus, subject to the expenditure on artificial manures, in favour of the Army Council's offer amounts to 4*s.* 7*d.* per qr of oats, delivered—38*s.* 6*d.* for 336 lb. being equal to 36*s.* 8*d.* for 320 lb. Thus:

	Per qr. of 320 lb. *s.*	*d.*
Army Council's offer	41	3
Food Controller's fixed price is equal to	36	8
Difference of bonus on ploughing up grass lands	4	7

This bonus in terms of acreage is shown as under:—

Assumed Crop.	Weight per Qr.	Bonus per Qr. *s.* *d.*	Bonus per Acre. *s.* *d.*
Four Quarters	320 lb.	4 7	18 4
Five ,, ...	320 ,,	4 7	22 11
Six ,, ...	320 ,,	4 7	27 6
Seven ,, ...	320 ,,	4 7	32 1

Forms of contract can be obtained from the Controller of Cultivated Land Areas (War Office) at 45, Parliament Street, London, S.W.

THE following Circular Letter was addressed by the Board on 16th January to railway companies:—

Cultivation of Railway Land.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to invite the assistance of your company in increasing the production of food, and with this purpose to urge that the fullest possible use should be made of suitable land adjacent to railway tracks and of other surplus land in your possession not immediately required for railway purposes.

Mr. Prothero thinks that it is probable that the most convenient arrangement would be that such land should be cultivated by the employees of the railway companies themselves. He is aware that such facilities are already liberally granted, but he trusts that your company may be able to encourage a still more extensive use of them and will do all they can to encourage their employees to avail themselves of such offers; and that they will also consider favourably any applications

they may receive from other persons who are prepared to undertake the cultivation of such land and who may safely be permitted to do so.

Mr. Prothero desires me to ask that these suggestions may receive the earnest consideration of your company at the earliest possible moment.

I am, etc.,
SYDNEY OLIVIER, *Secretary*.

LABOUR AND MACHINERY.

THE following Circular Letter was addressed by the Board on 16th January to War Agricultural Committees in England:—

Employment of Prisoners of War.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to advise you of the following scheme, which has been prepared by the Board in conjunction with the Army Council for the employment of prisoners for work in connection with agriculture.

1. Arrangements have now been made whereby all suitable prisoners of war, both military and civilian, who have had any experience of agricultural work, will be allotted to the Board of Agriculture and Fisheries, as well as a number of civilian prisoners of suitable physique who do not possess any previous agricultural experience. A proportionate number of these will be allotted to the Board of Agriculture for Scotland for work in that country, and a further number to the Welsh Agricultural Council for employment in Wales.

2. The number available for England will be distributed for agricultural work in the several counties in such numbers as the Board consider desirable. In the first instance the Board are able to place 75 prisoners at your disposal. Should the committee decide that they are unable to frame a scheme for their employment the Board should be informed not later than 30th January in order that the services of these prisoners may be utilised elsewhere.

3. Mr. Prothero is anxious that the executive committee of each County War Agricultural Committee should undertake the duty of deciding where the prisoners allotted for their county can best be employed; also the arrangement of certain details in connection with such work.

4. The prisoners will be supplied to the county in a batch or batches of not less than 75 in number, and with a view of economising military guards it is essential that arrangements be made for housing the prisoners in groups of not less than this number in depots from which they can be sent, or drawn, daily in small working parties, consisting as a rule of not less than five men. Prisoners thus employed will remain under military control, guards being provided both at the depot where they are housed and for each working party.

5. In deciding as to the district in which the prisoners allotted to any county can best be used, it is necessary that the committee should bear in mind—

(*a*) The necessity of some suitable building being available for use as a depot in a central position, and that such building should be capable of accommodating the prisoners, also that there is other accommodation near by for housing the guard, about 35 in number.

(*b*) That the prisoners can be employed only within a radius of about three miles of the depot, except in cases where special facilities are provided by employers or the Government for the transit of prisoners and their guards beyond that distance.

(*c*) That it is necessary that there should be sufficient work within the above radius to keep at least 65 of the prisoners employed for a period of not less than two months.

6. Detailed conditions under which prisoners can be employed are set out in the Statement $\frac{\text{A 209}}{\text{L}}$ enclosed (*see below*).

7. In addition to ordinary work of cultivation prisoners might be employed during the next few months in connection with the scouring or clearing of water-courses and ditches where neglect of such work is likely to prove detrimental to adjoining agricultural land, or other useful work which has a direct bearing on the increased production of foodstuffs in the immediate future.

8. It will be noted that the conditions of employment provide that two rates of wages for prisoners shall be recommended by the executive committee.

9. As soon as a scheme has been formulated by the committee for the employment of prisoners now placed at their disposal full particulars should be furnished to the Board, including a detailed statement as to the rates of wages recommended, and a description of the premises suggested as suitable for use as a depot. If the scheme and the recommendations as to the wages are approved by the Board, the War Office will be asked to make the necessary arrangements forthwith in order to supply the prisoners at the earliest possible date. The accommodation proposed will be inspected by the military authorities, when considered necessary, and will be subject to War Office approval.

I am, etc.,

SYDNEY OLIVIER, *Secretary.*

Conditions of Employment of Prisoners of War drawn from Depots for Farm Work.

1. Application for prisoners of war should be made to the Secretary of the War Agricultural Committee for the county.

2. The prisoners will be fed and boarded by the military authorities. Employers will not be required to provide any food for prisoners.

3. The rates of pay for day or piece work must be fixed by the executive committee of the War Agricultural Committee with due regard to the rates of wages current in the locality for ordinary agricultural labourers. Two scales of pay should be prepared, one for men having a previous knowledge of agriculture, and the other for the men lacking such experience. The scale when prepared must be submitted to the Board of Agriculture and Fisheries for consideration.

4. The executive committee must be satisfied that there is sufficient agricultural work in the locality to keep at least 65 of the prisoners fully employed for a period of not less than two months, after which time it will be open to them to recommend employment in another district subject to suitable arrangements being made. Application for the services of the prisoners at the depot must be made to the Officer Commanding the depot who will consult the executive committee in regard to any matters on which he requires advice.

5. The prisoners may only be employed during the hours of labour customary for agricultural labourers in the district, and no work should

be performed by them on Sundays, except the milking or tending of live stock, or attention to produce grown under glass and this only provided the prisoner is not engaged for more than two hours in all.

6. Employers will be required to pay the sum due for the hire of prisoners of war to the officer, or other authorised person, at the depot on the Monday or Tuesday following the week of employment.

7. As far as possible arrangements will be made whereby at least one prisoner in each working party shall possess some knowledge of the English language; but no guarantee can be given as to this.

8. Employers will not be liable to pay compensation for injuries under the Workmen's Compensation Act.

Private Employment of Combatant Prisoners of War.*

IT is officially announced that owing to the very large demands that have been made by Government Departments for the employment of *combatant* prisoners of war on work of the most urgent national importance, the Prisoners of War Employment Committee are unable to make any allocation in response to proposals put forward by private employers or local authorities.

There are, however, a certain number of prisoners at the various military camps who have already been allocated to various forms of work, but who cannot for the moment be employed thereon. Such prisoners may for the time being be employed on work within reasonable distance of the camp where they are confined if application is made to the Camp Commandant and he is able to make the necessary arrangements. They will, however, be liable to withdrawal to their more permanent occupations at a week's notice.

Agricultural Workers and the Army.

THE following Notice to farmers was issued on 16th January:—

The President of the Board of Agriculture and Fisheries has received a communication from the War Office this morning to the effect that it has been found necessary to call up one-half of those men engaged in agriculture, to whom the tribunals have refused Certificates of Exemption from military service.

Arrangements will be made as quickly as possible to place several thousands of Class C3 men at the disposal of farmers, and the President hopes that in the national interest farmers will do their best meanwhile to carry on in the very difficult circumstances in which they are placed.

Agricultural Workers and the Army.

THE Secretary of State for War and the President of the Board of Agriculture have issued the following letter, dated from the War Office on 24th January, for publication:—

Since October, 1916, local tribunals have refused certificates of exemption to 60,000 men engaged in agriculture. These men were granted leave by the War Office to remain on the land, first till 1st January, 1917, then till the agricultural census had been finished and analysed. The census and its analysis have now been completed. It

* A notice as to the employment of *civilian* prisoners of war in agriculture will be found in the *Journal* for January, p. 1018.

reveals a surplus of the rural population engaged in some branches of the cultivation of the soil for food (including fruit) and flowers.

That is the position from which we start. The urgent necessities of the military situation require that men under 25 should be taken, even from an industry so essential as agriculture. It affords some of the best fighting material which is available. Weeks ago the War Office based all their arrangements on the assumption that the men already given them by the local tribunals would be available in January. Unless the drafts are furnished the war may be indefinitely prolonged, and that prolongation can be good for no one. On the other hand, agriculture demands to retain for its needs all the skilled labour which it still possesses. These conflicting claims can only be reconciled if both the soldier and the farmer give up something.

Instead of the 60,000 men whom the local tribunals have already given to the Army as being, in their judgment and from their local knowledge, not essential, only 30,000 are to be called up. No more men above this number can be taken from agriculture without the express approval and sanction of the War Cabinet.

In order to make good the loss of 30,000 men, the military authorities have arranged to replace them by a corresponding number of substitutes. This replacement will be made within a few days, so that the gap may be filled at once. The men will not necessarily be skilled agriculturists. But a considerable proportion will be men skilled in the management of horses.

Besides reducing the number given by the local tribunals by one-half and replacing this half by a corresponding number of substitutes, the War Office is prepared to assist farmers in other ways. They undertake to return from the Colours the trained men in attendance on steam cultivators as soon as they can be traced. They offer, when baling wheat or oat straw, to fix a threshing drum to the baler to thresh the farmer's corn at pre-war prices. They will guard the German prisoners skilled in agriculture, both in their depots and when employed in gangs upon the land. They undertake to man, repair, and keep running the motor-tractors which will be placed at the disposal of war agricultural committees for ploughing and other agricultural operations. They will arrange, subject to the requirements of national defence, to send into districts most accessible to the military commands as many men as can be spared to help in the spring operations of ploughing and sowing. Efforts will be made by the War Office to supply as many more men as from time to time they may have at their disposal from C3 men or other sources.

The total volume of labour thus provided exceeds that which farmers have been able to command during the past eight months. We have suggested to the War Cabinet other means of increasing the supply, and no effort or money will be spared to double—again with the assistance of the War Office—the number of women who are willing to work on the land.

We are authorised to add that the War Cabinet are considering the possibility of giving credit to farmers against the produce which they contract to raise for the nation for the purchase of seeds, fertilisers, and feeding stuffs.

DERBY.
R. E. PROTHERO.

Settlement of Soldiers in the Empire.

THE Secretary of State for the Colonies has appointed a committee to consider and report on the measures to be taken for settling within the Empire ex-soldiers who may desire to emigrate after the war;

To collect and prepare for distribution to intending emigrants of this class information which shall show clearly the nature of any facilities afforded by the Governments of the Dominions and States;

To advise as to the best methods of making this information accessible to the troops;

To make recommendations as to the steps which should be taken by his Majesty's Government, in concert with the Governments of the States and Dominions, for the constitution of a central authority to supervise and assist such emigration.

Soldiers for Farm Work.

AN arrangement has been made between the War Office and the Board of Agriculture for placing a further supply of military labour at the service of farmers for spring cultivation. In addition to the allotment of 15,000 men now attached to home defence forces, whose labour will be made available to farmers under the arrangements hitherto in force, a further body of 15,000 men will be detached and quartered in different parts of the country.

The men will be quartered at infantry depôts selected by General Headquarters. Each company will have an establishment of 250, with a due proportion of warrant officers and non-commissioned officers, and will include men for clerical work to deal with applications from committees and farmers. A major, captain, and two subalterns will be appointed to each company.

The Board of Agriculture, in consultation with the war agricultural committees, has prepared a scheme for the distribution of this army of military labour between the various counties according to their requirements. The wages to be paid will be the local rates as determined by the war agricultural committees. Liberal allotments will be made to the more important wheat-growing counties, such as Norfolk.

Supply of Petrol to Members of Executive War Agricultural Committees.

THE following Circular Letter, dated 26th January, 1917, has been addressed by the Board to War Argicultural Committees :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that he has made representations to the Petrol Control Committee as to the need of increased allowances of petrol to members of Executive War Agricultural Committees or to surveyors and others working on behalf of the committees in connection with the survey or other official work of the Executive Committee.

Mr Prothero desires me to suggest that if increased allotments of petrol are required in such cases, the Executive Committee should apply accordingly to the Secretary, Petrol Control Committee, 19, Berkeley Street, W., stating the name and address of the licensee, the number of his licence and the increased quantity of petrol required, and sending a certificate signed by the Chairman of the Committee certifying that the increased quantity is essential to enable the officia work of the Committee to be carried out.

Any such applications will be favourably considered by the Petrol Control Committee, but in view of the urgent need for further limitation of the consumption of petrol, it is of great importance that no applications for additional allotments should be made unless they are absolutely essential to the successful prosecution of the War.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

Supplies of and Repairs to Agricultural Machinery.

THE Agricultural Branch of the Ministry of Munitions made, in January, an urgent appeal to all farmers to order at once whatever new machinery and implements they may require for this season's work, and also to place their orders for repairs to machinery and implements without any delay. Many manufacturers of agricultural implements are at present engaged on munitions work, and in consequence cannot execute orders placed by farmers with the despatch of previous years. Moreover, owing to the increasing demand on shipping, the arrival of machinery from abroad is uncertain.

Farmers who may experience any difficulty in obtaining supplies from manufacturers or agents, or in having repairs executed, should inform the Ministry of Munitions (Agricultural Machinery Branch), Whitehall Place, London, S.W., and state at the same time the requirements that are not being met.

POTATOES.

Distribution of Seed Potatoes for Small Growers.

THE following Circular Letter, dated 27th January, 1917, was addressed by the Board to County War Agricultural Committees in England and Wales :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's circular letters of the 10th and 23rd December last,* with reference to schemes for the distribution of seed potatoes to small growers, and I am to enclose a copy of a Memorandum† prepared by the Board for the information and assistance of your committee.

In view of the impression which has prevailed in some quarters that the Board proposed to undertake through the County War Agricultural Committees to supply seed potatoes to all small growers, Mr. Prothero considers it desirable to make the following observations on the matter :

1. The original purpose of the Board was to call the attention of the War Agricultural Committees to the successful results of the scheme carried out in Somerset last year, and to suggest that similar schemes might be initiated in other counties this year. In view of the shortage in supplies, and the consequent uncertainty as to prices, it appeared difficult, however, to adhere strictly to the condition of cash with order, and it was therefore contemplated that War Agricultural Committees might have to purchase sufficient seed potatoes to meet the probable demand from small growers without first collecting the money. In view of later developments it was considered desirable, in order to avoid competitive buying in a short market, to ask War Agricultural Committees to confine themselves to ascertaining the probable extent of the demand from small growers.

* See this *Journal* January, 1917. † See p. 1141 below.

2. Acting on this advice many War Agricultural Committees have sent particulars of the demand to the Board, but it appears certain that, in the absence of definite information as to the prices that will have to be charged, the quantities stated to be required cannot be regarded as firm offers, while the demand may also be modified by the fact that it will be impossible in all cases to obtain the particular varieties desired. It appears to be the case also that in many instances the stated demand includes the requirements of persons, such as ordinary potato growers and occupiers of private gardens, who are quite well able to obtain what they require in the ordinary course of trade. Mr. Prothero thinks it should be made clear that it is not intended that the War Agricultural Committees should replace the ordinary traders and undertake the supply of seed to all small growers. They should endeavour to confine their services to the case of the allotment holders and cottage gardeners, who are not ordinarily in a position to obtain good seed for themselves.

3. Mr. Prothero desires me to point out also that the action of the Food Controller in fixing prices for seed potatoes has completely changed the position since the issue of the Board's letters of the 10th and 23rd December. It would be possible in the new circumstances to leave growers to obtain their requirements in the ordinary course of trade, and in some cases War Agricultural Committees may consider this desirable.

4. On the other hand, it is probable that unless War Agricultural Committees assist the small growers referred to above, the latter will not be able to obtain good seed, and in this connection I am to inform you that the Board, in association with the Scottish and Irish Departments of Agriculture, have made arrangements by which seed can be purchased. These arrangements are explained in detail in the enclosed Memorandum. It must be clearly understood, however, that the Board themselves cannot undertake to do more than is indicated in paragraph 2*A* (*d*) (*e*) (*f*) of the Memorandum.

5. It is of the first importance that before undertaking a scheme for the supply of seed potatoes, War Agricultural Committees should consider carefully the means which they propose to adopt for distribution. In many cases it may be possible to secure voluntary agents at the stations at which the potatoes would be delivered. These agents should be authorised to incur expenses for cartage and handling. In other cases it may be more convenient to work through the ordinary channels of trade, and arrange that local dealers should become responsible for distribution within the county.

6. With regard to the finance of schemes I am to say that steps should be taken to ensure prompt collection of the money due from the purchasers, and, as stated in the enclosed Memorandum, committees will be wise to add a small charge for contingencies. If due precautions are exercised any possibility of loss on the transaction should be avoided, but should any unavoidable and irrecoverable loss be incurred, the Board will be prepared to meet the deficiency.

7. In conclusion, I am to urge on your Committee—

(*a*) That there will be great difficulty in securing supplies of seed, and that purchasers must be prepared to accept the best possible ;

(*b*) That in filling up forms of requirements, over-estimates must [illegible]voided ;

(c) That while different schemes of distribution may be suitable in different counties, in all cases very close supervision will be required, and the persons to whom the work is entrusted must be most carefully selected.

I am, etc.,
SYDNEY OLIVIER, *Secretary*.

Scheme for the Distribution of Seed Potatoes to Small Growers through County War Agricultural Committees.

1. Object of the Scheme.—The object of the Scheme is to increase the production of potatoes on allotments, in cottage gardens, and among small holders throughout England and Wales.

In order to secure this object the provision of suitable "seed" is necessary, but, owing to the scarcity of the supply of potatoes suitable for planting this season, distribution will usually be confined to ordinary main crop varieties. Where supplies of once-grown "seed" are already available in the locality it is important that every endeavour should be made to utilise them.

County War Agricultural Committees are invited to undertake the organisation of the scheme throughout their respective counties; to obtain particulars through local authorities and district and local committees of the quantities and varieties of seed required, and to arrange for the distribution of the seed when delivered. In all cases they must arrange for the collection of the money from the individual purchasers, who must pay cash on delivery and should be granted as favourable terms as possible. War Agricultural Committees, are authorised at their discretion to give credit up to the extent of one-third of the total value of the purchase to registered societies of smallholders affiliated to the Agricultural Organisation Society.

The quantity of "seed" obtainable by any individual grower under this scheme must not exceed 5 cwt.

2. Methods of Securing and Distributing Seed Potatoes.—(*A*.) *Method of Securing Supplies*.—The Board will assist War Agricultural Committees who adopt the scheme to obtain supplies. The following procedure is suggested for this purpose:—

(*a*) The War Agricultural Committee should forward to the Board as soon as possible, and in any case not later than the 15th February, 1917, a return of their requirements on the form which accompanies this Memorandum.

(*b*) The War Agricultural Committee, having regard to the most convenient place for the sub-division of consignments, should indicate those centres in the county to which the potatoes may be dispatched in quantities of not less than 4 tons.

(*c*) The War Agricultural Committee must give the name of a responsible representative at each centre to whom the potatoes may be consigned. The consignee should take charge of the consignments on behalf of the War Agricultural Committee and inform the Board immediately of the arrival of the potatoes.

The Board on receiving the return of the War Agricultural Committee's requirements will take steps:—

(*d*) To place the order.

(*e*) To arrange for the potatoes to be delivered as economically and expeditiously as possible at the stations indicated by the War Agricultural Committee.

(*f*) To send for the information of the War Agricultural Committee a copy of the order which has been sent to the supplier of the seed potatoes.

(*g*) To arrange for the invoice to be sent to the Secretary of the War Agricultural Committee on the dispatch of the potatoes.

The accounts for potatoes and carriage and all other charges must be paid by the War Agricultural Committees within one month of the date of delivery.

The Board have made arrangements with the railway companies for the transit of seed potatoes consigned to the orders of War Agricultural Committees. The arrangements made ensure one month's credit being given for all railway charges, and the railway companies will arrange to notify their staffs accordingly. This has been done to enable War Agricultural Committees to collect the sums due for seed potatoes before having to meet the railway charges.

(*B*) *Method of Distribution*.—The actual distribution of seed to purchasers must be undertaken by the War Agricultural Committee, who must accept full responsibility for providing means to secure local delivery to the purchasers, and collection of the money on delivery.

Distribution may be effected either through a voluntary organisation for each local centre, or through trade agencies. Two methods are suggested :—

(A) Distribution on the lines followed last year in Somerset, when the Agricultural Instruction Committee of the county council organised the scheme.

If it is decided to adopt a system of this kind, the attention of the committee is directed to the following points :—

(1) The Chairman of the District Council or District War Agricultural Committee or a deputy selected by him should be invited to act as consignee at each centre to which a consignment of not less than 4 tons is dispatched. The consignee should be provided by the Secretary of the War Agricultural Committee with full particulars of the destination of all potatoes in the consignment.

(2) The consignee should be held responsible for the arrangements for delivery to local purchasers, and for the re-consignment of such potatoes as are to be dispatched in small quantities by rail. He should be authorised where necessary to obtain assistance, but it will no doubt be found that the railway staff will be willing to render most of the assistance necessary.

(3) Each consignment of 4 tons or more may fall into two groups :—

(*a*) Potatoes ordered by local residents.

(*b*) Potatoes which must be re-consigned by rail.

(4) The consignee should be instructed to collect the money for the potatoes from the purchasers in Group (*a*). He should advise the local residents of the probable date of the arrival of the potatoes, and instruct them to call for them at the station, pay for them, and take them away.

(5) In the case of Group (*b*) the consignee should arrange for the separate small consignments to be re-dispatched by rail to the purchasers' nearest station consigned to the person nominated to take charge of them at that point; the latter consignee should arrange for delivery to the purchaser and for the collection of the money.

Where a local society, either a Horticultural or Allotment Society, exists it will no doubt be possible to secure the interest of the officers and members in organising local distribution and collecting the money.

(6) Where purchasers are situated some distance from the stations and have no means of conveying potatoes to their homes, neighbouring farmers and others should be invited to assist them.

(B) Distribution by dealers in "seed" potatoes selected by the War Agricultural Committee, who would undertake the sale, distribution, re-consignment, and delivery of the "seed" on terms to be arranged by the Committee.

This effort to increase the food supply by the distribution of potatoes for planting by small growers will no doubt be regarded by them as War work, and it is expected that dealers would be prepared to distribute "seed" on very reasonable terms.

If this method is adopted, it will be necessary for War Agricultural Committees to come to a definite understanding with traders in the county, and it is suggested, in order that distribution may be undertaken on a uniform system, that a small committee of these dealers trading in the county should be formed and invited to organise distribution and the collection of the money.

War Agricultural Committees are requested to indicate to the Board which of the two methods they propose to adopt.

The success of either scheme will depend almost entirely on the care with which local arrangements for distribution of the seed and collection of the money are organised, and it is desirable that the system should be carefully considered so as to meet local requirements.

3. Varieties of Seed Potatoes to be Supplied under the Scheme.—Owing to the scarcity of seed potatoes this season it will be quite impossible to guarantee the supply of any special variety.

First and Second Earlies are very difficult to obtain, and it is improbable that they can be provided. Purchasers must therefore be content to accept good sound "seed" of any maincrop variety suitable for planting in the district.

In areas infected with wart disease, resistant varieties *must* be selected.*

So long as the supply holds out the seed potatoes will be obtained from Scotland, the North of Ireland, or from stocks "once grown" in certain districts in England.

The potatoes will be forwarded in non-returnable bags, containing 1 cwt., and will be supplied "as dressed by the grower."

4. Price.—The following notice has been issued by the Food Controller regarding the prices fixed for the sale of seed potatoes. It will be noted that these are maximum prices to the grower f.o.r. *or* f.o.b.; they do not include cost of bags, rehandling or carriage

In order to ascertain the actual cost of the potatoes to the committee, the carriage and the cost of the "seed" as shown on the invoice must be considered, and to this should be added a charge which would probably not exceed 9*d*. per cwt. for distribution.

As a guide to the cost of carriage, the following examples of 4 ton rates from Perth to various stations in England may be cited :—

* See this *Journal*, January, 1917, p. 1017.

Rates between :	Potatoes in 4-ton lots. s. d.
Perth and York	23 5 per ton.
,, Crewe	26 10 ,,
,, Peterborough	29 6 ,,
,, Norwich	32 1 ,,
,, Bristol	32 1 ,,
,, Plymouth	38 2 ,,
,, Winchester	38 2 ,,
,, Chelmsford	32 11 ,,

The following are examples of freights from Ireland :—

Rates between :	Potatoes in 4-ton lots. s. d.
Belfast and Merthyr Tydfil *via* Cardiff	24 4 per ton.
,, ,, Pembroke ,, Swansea	28 4 ,,
,, ,, Pontypool Road ,, Cardiff	24 6 ,,

Port dues are excluded from these charges.

As an example of the method of arriving at the price at which potatoes can be sold to the purchaser in quantities of 5 cwt. and under, the following cases may be quoted :—

Consignment of 4 tons of "Arran Chief" from Perth to Chelmsford—

	£	s.	d.	
Price paid to grower*	12	0	0	per ton.
Commission, sacks and handling, say	1	3	0	,,
Carriage	1	13	0	,,
Distribution charges, say	0	15	0	,,
	£15	11	0	

Consignment of 4 tons of Up-to-Date variety of Irish "seed" sent from Belfast to Brecon—

	£	s.	d.	
Price paid to grower	9	0	0	per ton.
Commission, sacks and handling, say	1	3	0	,,
Carriage	1	6	0	,, approx.
Distribution charges, say	0	15	0	,,
	£12	4	0	

Consignment of 4 tons of Dalhousie variety of twice grown seed ent from Lincoln to Plymouth—

	£	s.	d.	
Price paid to Grower	7	0	0	per ton.
Commission, sacks and handling, say	1	3	0	,,
Carriage	1	6	0	,,
Distribution charges, say	0	15	0	,,
	£10	4	0	

These potatoes could not therefore be sold for less than 15*s*. 7*d*., 2*s*. 3*d*., and 10*s*. 3*d*. per cwt. respectively and, as there will be a loss weight through dividing up the consignment into small lots, the mmittee are advised to add a charge of, say, 4*d*. per cwt. to cover ntingencies.

* See p. 1146.

Maximum Prices for the 1916 Crop of Potatoes.

On 1st February the Food Controller made an Order—The Potatoes, 1916, Main Crop (Prices) Order, 1917—prohibiting the sale of potatoes of the 1916 crop at prices above certain fixed maxima. In the case of the grower these maxima did not include cost of transport bags or other packages; and where prices under existing contracts exceeded these maxima the contract was to be avoided so far as concerned any potatoes which had not either been delivered or paid for at the date of the Order.

Since the Order was made the fixed prices have been altered with the approval of the War Cabinet, and the arrangements are now as follows :—

"The price which the growers will be entitled to charge to dealers and merchants for potatoes delivered up to 31st March will be £9 per ton, free on rail or free on board. After that date the corresponding price will be £10.

"The price at which the growers or any other person may sell to the retailer will be 10 guineas until 31st March, and £11 10*s*. thereafter, in addition to the cost of carriage.

"The price which the retailer may charge will be 1½*d*. per lb. up to 31st March and 1¾*d*. per lb. thereafter to the end of June."

It will be noticed that where growers sell to dealers or merchants the fixed prices include costs of transport to rail or boat and loading.

The above Order did not apply to seed potatoes.

Minimum Prices for the 1917 Crop of Potatoes.

THE following Official Announcement by the Food Controller was issued on 19th January :—"The announcement appearing in the Press on 9th January as to the fixing of prices by the Food Controller, after consultation with the Agricultural Departments of Great Britain and Ireland, for potatoes of the 1917 main crop, has been further considered in view of the possibility of an unfavourable season. It has been decided accordingly that the prices named for potatoes shall not be regarded as contract prices, but as minimum prices guaranteed by the Government for potatoes of the first quality."

The fixed prices named in the announcement of 9th January, and which are now declared to be guaranteed minimum prices, were as follows for main crops of potatoes of first quality, delivered in quantities of not less than 6 tons, free on rail or board :—

115*s*. per ton for delivery from 15th September to 31st January.
120*s*. ,, delivery in February and March.
130*s*. ,, the remainder of the season.

Maximum Growers' Prices for Seed Potatoes.

AN Order of the Food Controller, fixing maximum growers' prices for seed potatoes, came into force on 22nd January. The following are the operative provisions of the Order :—

1. Except under the authority of the Food Controller no seed potatoes of any of the varieties mentioned in the First Schedule may be sold by or on behalf of the grower thereof at a price exceeding the price applicable thereto according to such schedule.

2. The price shall be the price for potatoes delivered free on rail or free on board at the option of the seller, but shall not cover the price of bags or other packages.

3. No grower and no agent of any grower shall sell or offer to sell any seed potatoes grown by such grower, and no person shall buy or offer to buy any such seed potatoes from such grower or his agent at a price exceeding the price applicable thereto.

4. For the purpose of this Order the following expressions used herein and in the schedules hereto shall have the following meanings :—

(*a*) Seed potatoes shall mean potatoes of a variety specified in the first column of the second schedule of this Order, which will pass through a riddle having such mesh as is specified in the second column of such schedule in relation to such variety, and will not pass through a riddle having such mesh as is so specified in the third column of such schedule.

(*b*) *Class I. shall mean seed potatoes grown in Scotland or in Ireland* in 1916.

(*c*) Class II. shall mean seed potatoes grown in England and Wales in 1916 from seed grown in Scotland or in Ireland in 1915.

(*d*) Class III. shall mean seed potatoes grown in England or Wales in 1916 from seed grown in England or Wales in 1915.

5. Any person acting in contravention of this Order is guilty of a summary offence against the Defence of the Realm (Consolidation) Regulations, 1914.

6. (*a*) This Order may be cited as the Seed Potatoes (Growers' Prices) Order, 1917. (*b*) This Order shall extend to England, Ireland, Wales, and the mainland of Scotland and the Islands of Bute and Arran.

Schedule I. gives the following as the maximum prices per ton to growers for Classes I., II., and III., of the varieties named :—

Early Puritan, Duke of York, Epicure, and Eclipse, £12, £11 and £9.
Sharp's Express, £12, £11, and £9.
British Queen, £10, £9, and £7.
King George V., £12, £11, and £7.
Great Scot, £14, £13, and £10.
Royal Kidney, £9, £9, and £7.
Evergood, £12, £11, and £8 10*s*.
King Edward VII., £11, £10, and £8 10*s*.
Arran Chief, £12, £11, and £9.
Irish Queen and President, £10, £9, and £7.

Factor, Table Talk, Dalhousie, Up-to-Date, Scottish Triumph, Duchess of Cornwall, Langworthy, What's Wanted, Golden Wonder, Abundance, Favourite, Twentieth Century, Northern Star, Black Skerry, Champion, Beauty of Bute, £9, £8, and £7.

Schedule II. gives for the varieties of potatoes named below the following sizes of the meshes of riddles through the first of which seed potatoes must pass and not through the second :—

Part I.—Potatoes grown in the Mainland of Scotland and the Islands of Arran and Bute :—

Arran Chief, 2¼ in. and 1 in. ; King Edward, 2 in. and 1 in. ; President, 2 in. and 1¼ in. ; Evergood, 2 in. and 1¼ in. ; British Queen, 2 in. and 1¼ in. ; *Great Scot*, 2¼ *in. and* 1 *in.* ; King George V., 2¼ in. and 1 in. ; all other varieties so grown, 1⅝ in. and 1¼ in.

Part II.—Potatoes grown in England and Wales from Scotch seed of the 1915 crop :—

Arran Chief, 2 in. and 1 in.; King Edward, 1¾ in. and 1¼ in.; British Queen, 1⅝ in and 1¼ in.; Great Scot, 2 in. and 1 in.; King George V., 1¾ in. and 1¼ in.; Evergood, 1¾ in. and 1¼ in.; Royal Kidney, 1¾ in. and 1 in.; all other varieties so grown, 1⅝ in. and 1¼ in.

Part III.—Potatoes of all varieties grown in England and Wales from seed other than Scotch seed of the 1915 crop :—1⅝ in. and 1¼ in.

Part IV.—Potatoes grown in Ireland :—1⅝ in. and 1¼ in.

Wart Disease of Potatoes Order of 1917.

THE Wart Disease of Potatoes Order of 1917 of the Board of Agriculture and Fisheries, which came into force on 1st February last prohibits the planting of potatoes on premises where Wart Disease has occurred, except by licence to be obtained from an inspector of the Board or of the local authority.

WOMEN AND CHILDREN.

Employment of Women in Agriculture after the War.

THE Women's Employment Sub-Committee of the Committee on Reconstruction are collecting information from the Women's County Committees, and from other bodies and persons who are able to speak from the women's point of view, on the subject of the opportunities for the employment of women, and the conditions of such employment, in agricultural occupations after the War.

The Sub-Committee further requested the President of the Board of Agriculture to obtain the farmer's opinion on the matter. Accordingly on 19th January the President addressed a circular letter to War Agricultural Committees, asking them to obtain information from three representative farmers in each county who have had experience of the employment of women on their farms. The information is being obtained by means of a form addressed to such farmers, requesting replies to relevant questions.

Growing of Food in School Gardens.

THE Board of Education have addressed to local education authorities a letter dealing with the growing of food in school gardens, in which it is stated :—

Suggestions have been made that, in order to increase the supply of food, school gardens should be used exclusively or mainly for the cultivation of potatoes. This suggestion would involve the abandonment or curtailment of the ordinary courses of instruction given in connection with school gardens. While the Board of Agriculture consider that special attention should be given at present to vegetables which are valuable as staple foods, and more attention than usual to the growing of potatoes, they do not desire that the ordinary courses of gardening instruction should be seriously disturbed. They regard, in fact, the maintenance of efficient instruction in gardening, and particularly in the growing of different kinds of the most useful vegetables, with special regard to food values, as very important. They are anxious that children should be made to feel that they are doing national

work by growing vegetables for the nation's need, and believe that in time to come they will like to think that, young as they were, they did their part in the great war.

Where the area of school gardens can be increased by taking charge of the cultivation of vacant allotments or gardens near the school, without placing too great a strain on the teachers and children and disorganising the ordinary school work, the Boards of Agriculture and Education recommend such an arrangement. In some places arrangements may be successfully made for enlisting the help of children on such land out of school hours.

The Board of Agriculture do not think children can be suitably or usefully employed in breaking up waste lands in urban areas and planting them with potatoes; but it is not intended to discourage the use of waste land for school gardens if it is suitably prepared and placed at the disposal of local education authorities. The Royal Horticultural Society have promised all the help in their power in obtaining the voluntary services of skilled gardeners to assist teachers in the cultivation of school gardens; and applications for such help should be sent to the secretary of the society, Vincent Square, Westminster, S.W.

MISCELLANEOUS.

Supply of Bee Candy.

IT is announced by Messrs. Jas. Pascall, Limited, of 100, Blackfriars Road, S.E., that they have now received from the Royal Commission on the Sugar Supplies 50 tons of sugar for the purpose of supplying bee-keepers with candy during the next few weeks.

The candy, which has been stained pink to designate the purpose for which it is to be used, has been medicated with bacterol, an antiseptic compound which, while harmless to bees, renders the sugar unfit for human consumption. It can be obtained from Messrs. Pascall at the following prices:—

5 lb. box, containing five 1 lb. cakes, at 4*s.* 7*d.*, plus postage 8*d.*

Four boxes at 18*s.*, carriage forward.

Cases containing 24 boxes can be obtained at slightly lower prices, which will be sent on application.

The money must be sent with the order.

Messrs. Pascall have fixed a price which covers the cost of production with a small margin for contingencies only. Any profit that may be made above this amount will be handed over to any charity that the Board of Agriculture and Fisheries care to name.

Dealing in Wool by Persons Other than Growers.

THE Army Council issued an Order on 15th January, 1917, to the following effect:—Whereas the Army Council deem it advisable that persons other than growers should be permitted to deal freely in wool as in the said Order defined, provided that such sale is completed on or before 1st March, 1917, they authorise and permit the sale of raw wool grown on sheep in Great Britain, Ireland and the Isle of Man prior to the 1st January, 1917, by all persons other than growers, provided that such sale is completed on or before 1st March, 1917.

Restriction of Materials Used in Production of Beer.

THE Food Controller has announced that, after a careful investigation of the resources available for the food of the people, he has come to the conclusion that it is imperative to restrict the materials to be used in the production of beer.

He has accordingly proposed that as from 1st April, 1917, the beer which is allowed to be brewed under the Output of Beer (Restriction) Act, 1916, shall be reduced to 70 per cent. of the output for the current financial year ending on 31st March, 1917.

The result of such a restriction will be to increase the amount of barley, sugar, and other brewing ingredients available for the purposes of food, and also to economise tonnage, transport, labour, and fuel.

The War Cabinet have approved this proposal, and have decided that a corresponding restriction shall be placed upon the release of wines and spirits from bond. A Bill for these purposes will be introduced in the present Session of Parliament.

In order to prevent forestalments, the Commissioners of Customs and Excise, acting under the authority of the Treasury, have given directions which will restrict the daily deliveries of wines and spirits out of bond during the period ending 31st March next to amounts not exceeding the daily average for the year 1916.

Sale of Malt.

THE Food Controller has made the following Order, entitled the Brewers' (Malt Purchases) Order, 1917, dated 3rd February, 1917:—

1. Except under the authority of the Food Controller, no maltster or dealer in malt shall on or after the 10th February, 1917, agree to sell any malt to any brewer for sale or make delivery to any brewer for sale of any malt other than malt deliverable under contracts made before that date.

2. Except under the authority of the Food Controller, no brewer for sale shall on or after the 10th February, 1917, agree to buy any malt or to take delivery of any malt other than malt deliverable under contracts made before that date.

3. Except under the authority of the Food Controller, no brewer for sale shall manufacture any malt from any barley agreed to be bought on or after the 10th February, 1917.

Census of Stocks of Barley and Malt.

AN Order has been issued by the Food Controller, requiring a Return of stocks of malt suitable for use in brewing beer, of stocks of barley, and other cognate information. The Return must be made as for Saturday, 10th February, and must be furnished to the Ministry of Food not later than Saturday, 17th February.

The Order applies to all maltsters, dealers in malt, brewers for sale, and to such other persons as the Food Controller may require. Forms of Return have been sent to the various establishments concerned, so far as they are known. The obligation to make a Return, however, is imposed whether or not the form is so sent. In particular, information is required as to:—

(a) Stocks of home-grown and imported barley and malt in possession, and of home-grown and imported barley in process of being malted, and of the places where stored or being malted.

b) The dates of and parties to any contracts for sale or purchase of home-grown and imported barley and of malt, and the amounts thereof delivered and remaining to be delivered, together with the dates for delivery and of shipment.

(c) Quantities of malt manufactured during the years 1st July, 1913, to 30th June, 1914; 1st July, 1914, to 30th June, 1915; and 1st July, 1915, to 30th June, 1916.

(d) The output capacity per steeping of any malting.

The expression "brewer for sale" is defined as meaning "any person who brews beer for the use of any other person at any place other than the premises of the person for whose use the beer shall be brewed, and any person licensed to deal in or retail beer who brews beer." "Malt" means malt suitable for use in the brewing of beer. "Beer" includes ale, porter, spruce beer, black beer, and any other description of beer.

Manufacture of Flour and Bread Order, 1917.*

THE Food Controller announces that copies of the Manufacture of Flour and Bread Order, 1917, are now available for general use. The Order has been drafted so as to proceed on the percentage basis to which millers are accustomed to work, but its effect may be stated without reference to technicalities.

All flour milled from wheat must be straight-run flour, and the miller is required to obtain a certain percentage, called the prescribed percentage. The percentage varies with the different qualities of wheat used, and the average percentage is 76.

The miller is not, however, allowed to stop short at the prescribed percentage, but is required to obtain five points beyond this. These further five points may be obtained either by milling the wheat to a higher percentage or by adding flour ground from rice, barley, maize, and oats or any mixture of these grains, or in both of these ways.

In addition the miller has an option to add a further five points obtained in the same way. The effect of this option is practically that a sack of 280 lb. of flour may contain, in addition to any compulsory admixture, about 17 lb. of flour ground from rice, barley, maize or oats.

It has been represented to the Food Controller that it would be a great convenience to millers to know exactly in any particular case how much flour in any sack of 280 lb. *must* be and how much *may* be flour milled from rice, barley, maize or oats. The Food Controller has accordingly had prepared a table showing this, which will be available for millers. For those millers who wish to work to a percentage on any quantity of the finished product the following rule is approximately accurate (and may be worked to) :—For every one per cent. by which the actual percentage falls short of the prescribed percentage plus five, the miller *must*, and for every one per cent. by which the actual percentage falls short of the prescribed percentage plus a further five, the miller *may*, mix with the wheaten flour a quantity of the permitted added substance which shall equal 1¼ per cent. of the finished mixed flour. (*Board of Trade Journal*, 25th January, 1917.)

* The Order was announced in this *Journal* for January, 1917, p. 1005.

THE Secretary of the Royal Commission on Wheat Supplies ssued the following announcement on 27th January :—

Importation of Rice.

1. The Food Controller has decided that the Royal Commission on Wheat Supplies shall control the importation of rice for sale in the United Kingdom.

2. The trade have been informed that they must make returns for all holdings of rice not arrived and not purchased for the United Kingdom on ex ship or delivered terms, which are taken over at to-day's c.i.f. price.

3. Present holders of rice are free to act as agents of the Royal Commission for resale of their holdings at prices to be fixed from time to time by the Commission, and they will be paid a brokerage on such sales. The amount of such brokerage will be fixed at a later date by the Commission.

4. All holders of rice to arrive are required to furnish the Royal Commission on or before 1st February, 1917, with full particulars of (*a*) their holdings of rice, and (*b*) freight engaged for the transport of rice and rice products to this country.

Committee on Fertilisers.

THE Food Controller announces that he has appointed a committee to make such arrangements as may be necessary and expedient for the increase of supplies of fertilisers in the United Kingdom, and for controlling so far as may be necessary their output and distribution.

The following are the members of the Committee :—Capt. Charles Bathurst, M.P. (chairman); Mr. H. R. Campbell, B.Sc.; Sir James J. Dobbie, D.Sc., F.R.S.; Mr. R. R. Enfield; Capt. R. B. Greig, M.C.; Mr. T. H. Middleton, C.B.; Mr. W. Anker Simmons; Professor W. Somerville, D.Sc.; Mr. G. J. Stanley, C.B., C.M.G.; Mr. R. J. Thompson; and Professor T. B. Wood, M.A.

Mr. H. Chambers will be the Secretary to the Committee.

Sulphate of Ammonia: Fixed Price and a Committee on Distribution.

THE Food Controller, with the concurrence of the Agricultural Departments of Great Britain and Ireland, has approved of an arrangement by which sulphate of ammonia is to be sold at £16 per ton, 24½ per cent. basis, in makers' bags, net cash, delivered at the consumer's station in any part of the United Kingdom. The price to consumers who take delivery at the producer's works for conveyance otherwise than by railway remains at £15 10s. per ton. Any purchaser experiencing difficulty in obtaining supplies locally should apply to the Secretary, Sulphate of Ammonia Advisory Committee, 84, Horseferry Road, London, S.W.

Lord Devonport has appointed the following committee of manufacturers of sulphate of ammonia to advise him on questions affecting its production and distribution, and to give effect to an approved scheme for regulating the distribution of supplies to farmers in all parts of the United Kingdom :—

Mr. D. Milne Watson (chairman), Gas Light and Coke Company.
Mr. Wm. Fraser, Pumpherston Oil Company (Limited).
Mr. E. J. George, Consett Iron Company (Limited).

Mr. W. R. Hann, Powell, Duffryn Steam Coal Company (Limited).
Mr. N. N. Holden, Messrs. Hardman and Holden (Limited).
Mr. A. E. McCosh, Messrs. Wm. Baird and Co. (Limited).
Alderman F. S. Phillips, Salford Corporation Gas Department.
Mr. A. Stanley, Messrs. Simon-Carves (Limited).
Mr. F. C. O. Speyer (secretary).

Show Societies and the Production of Food.

ON the 15th January the President of the Board of Agriculture drew the attention of all agricultural show societies to the generous and patriotic effort of the Royal Lancashire Agricultural Society to stimulate the production of home-grown foodstuffs in their district; this effort has taken the form of awarding prizes to small plot holders for growing potatoes, and prizes for herds of dairy cows, growing root crops, potatoes, turnips and mangolds, and for increased cropping during the year 1917. Mr. Prothero expressed the hope that the example set by the Lancashire Society might be followed by other societies throughout the country, and made his appeal on the ground of the vital importance of doing everything possible to encourage the production of home-grown food of every description.

The President suggested that a further direction in which encouragement might be given by societies lay in the award of prizes to pig clubs or other societies, or alternatively the presentation of sows to pig clubs or other societies.

Prices and Supplies of Agricultural Produce.

PART III. of the Agricultural Statistics for 1915, dealing with prices and supplies of corn, live stock, and other agricultural produce in England and Wales in 1915 has now been issued (Cd. 8391, price 3*d.*).

In his report which prefaces the tables in this part, Sir Henry Rew arrives at 138 as the general index number of prices of produce sold off the farm in England and Wales in 1915, the average prices from 1906-8 being taken as the basal prices (=100). The index number in 1914 was 111, so that prices increased 24 per cent. in 1915 over 1914. Representing the average prices of farm produce in 1906-8 as 100, the prices in 1915 are given as follows:—Cattle 150, milk 124, sheep 126, pigs 144, hay 124, wheat 156, barley 166, potatoes 120, poultry and eggs 124, fruit 105, wool 190, butter 123, oats 163, hops 140, cheese 131, beans and peas 149, vegetables, 153.

Price of Summer Milk.

THE Food Controller has decided that the Price of Milk Order shall continue in force throughout the summer, but he has modified it in two particulars.

Milk delivered at creameries will in future be on the same footing in the matter of maximum price as milk delivered on other premises; and the exceptional price granted for accommodation milk is expressly disallowed in the case of milk sold by the producer.

*** The Price of Milk Order will be found in this Journal for January, 1917, p. 1,023.

AN Order of the Local Government Board, amending the Public Health (Milk and Cream) Regulations, 1912, was published in the *London Gazette* of 9th February, 1917.

Preservatives in Cream.

It provides that every receptacle containing preserved cream shall be labelled by affixing thereto an adhesive label in the form prescribed (referred to as the "declaratory label"), provided that, where the receptacle is made of cardboard, the declaratory label may be printed on the outside of the cardboard itself.

Every declaratory label shall be in the form and contain the information indicated in Label I. or Label II. set out below, as the case may require. Such information shall be printed in dark coloured type, of not less size than that shown in the said Label I. or Label II., upon a white or cream-coloured ground in the centre of the declaratory label, and nothing else shall be printed on the declaratory label; except that in every case in which Label I. is used the maximum amount per cent. of boric acid (H_3BO_3) contained in the preserved cream shall be stated in figures on the declaratory label.

LABEL I.
PRESERVED CREAM
containing BORIC ACID
not exceeding PER CENT.
NOT SUITABLE FOR
INFANTS OR INVALIDS.

LABEL II.
PRESERVED CREAM
(PEROXIDE)
NOT SUITABLE FOR
INFANTS OR INVALIDS.

The declaratory label shall not be affixed or printed either over the mouth of the receptacle or beneath the receptacle.

At present no preservative substance other than (i.) boric acid, borax, or a mixture of those preservative substances; or (ii.) hyrogen peroxide may be added to cream containing 35 per cent. or more by weight of milk fat in any case in which the cream is intended for human consumption; the same rule applies to imported cream. The new Order provides that on and after April 2nd next the words "in amount not exceeding 0·4 per cent. boric acid (H_3BO_3) by weight of the preserved cream" shall be inserted after the words "boric acid, borax, or a mixture of those preservative substances." The effect is to define the maximum amount of preservative which may be used.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

Manurial Value of Mineral Phosphates (*Jour. Agric. Research*, vi., 13).—Pot experiments, comprising 700 pot cultures, were carried out over 3½ years. Pure white sand free from phosphorus was used as soil, and to this applications of plant food (consisting of ammonium nitrate, potassium sulphate, magnesium sulphate and ferric chloride) were made when the crops were planted and at intervals thereafter. The water-content of the pots was maintained at 14 per cent. The fineness of the mineral phosphates used was such that they passed through a sieve of 100 meshes to the inch.

The bulk of the experiments seem to have been carried out with Tennessee Brown Rock Phosphate. The crops tested, the amounts of "total" phosphate applied, the yields obtained, and the proportion of added phosphorus removed by the plants were as follows :—

Phosphate Added.	Dry Matter.							
	Spring Wheat.			Oats.			Timothy (3 cuttings) Crop.	Red Clover Hay (3 cuttings) Crop.
	Grain	Straw	Percentage of Phosphorus Removed.	Grain	Straw	Percentage of Phosphorus Removed.		
gm.	gm.	gm.	per cent.	gm.	gm.	per cent.	gm.	gm.
0	0	6·2	—	0	6·0	—	3·09	6·0
11	1·2	17·5	·78	4·6	10·3	·88	24·60	11·1
22	4·0	21·2	·58	7·4	13·8	·67	33·45	29·4
66	12·7	37·6	·44	11·5	17·0	·40	61·50	55·2
220	17·1	41·6	·24	15·5	21·4	·22	67·50	97·8
	Cowpeas.			Soybeans.			Lucerne (4 cuttings).	
0	0·1	2·7	—	1·0	8·6	—	1·44	
11	0·3	4·6		2·4	9·7	1·04	3·44	
22	1·0	7·1	0·40	2·9	12.1	·62	40·4	
66	11·9	25·7	0·75	3·1	15·1	·29	54·8	
220	13·1	26·7	0·29	4.4	14·3	·11	64·0	

This table shows a steady increase in the yield of the crops with increased application of Tennessee Brown Rock Phosphate. The author makes the statement that "scarcely more evidence is necessary to show that wheat is able to take its phosphorus supply from Tennessee Brown Rock Phosphate." The percentage of phosphorus in the plant (not shown above) in the majority of cases increased as the application of raw rock grew larger. As high as 2·49 per cent. of the phosphorus supplied in raw rock phosphate was removed in one season's growth of lucerne.

A further series of experiments was planned to determine the comparative value of mineral phosphates from the various mines of America.

Equal amounts of "total" phosphates in the various forms were applied. The phosphates, the citric solubility, and the yields were as follows :—

Mineral Phosphates.	*Citric Solubility.*	*Red Clover. (2 cuttings).*	*Oat Straw.*
	Per cent.	gm.	gm.
Tennessee Brown Rock ..	78 ..	7·4 ..	5·2
Tennessee Blue Rock ..	77 ..	5·2 ..	2·7
Florida Soft Rock	76 ..	10·9 ..	2·1
Utah Rock	63 ..	5·8 ..	1·5
South Carolina Land Rock ..	50 ..	2·4 ..	2·2
Canadian Apatite	44 ..	0·0 ..	1·4

The yields shown are the average in each case of applications of phosphate at three different rates, viz., 1·81 gm., 3·62 gm. and 10·86 gm.

per pot. A conclusion of the author that there was "no particular relation between the citric-acid-soluble phosphorus and the availability of these phosphates for plants" hardly seems borne out by the data in the above table.

It was shown that plants obtained their calcium, as well as their phosphorus, from brown rock phosphates; no better results were secured when calcium carbonate was applied than when rock phosphate alone was used.

An experiment to test the effect of fineness of grinding on the yield of oats gave the following results:—

Meshes to the inch.	*Yield of Grain.* gm.	*Yield of Straw.* gm.
80—100	4·55	7·09
100—200	5·47	9·57
Over 200	6·20	9·82

Manuring of Turnips (*N. of Scotland Coll. of Agric., Leaflet No.* 51).—This experiment, to test the values of (1) different forms of phosphates, and (2) different mixtures of various forms of phosphates, was carried out on recently reclaimed soil in very poor condition, the unmanured plot yielding practically nothing. The yields per acre obtained from the use of manures were: 7 cwt. superphosphate, 16 tons 6 cwt.; 4 cwt. steam bone flour (60 per cent.), 14 tons 13 cwt.; 8 cwt. ground mineral phosphate (62 per cent.), 13 tons 19 cwt.; 8 cwt. basic slag (34 per cent.), 13 tons 3 cwt. As regards the mixtures, 2½ cwt. superphosphate and 5½ cwt. basic slag gave a yield per acre of 17 tons 14 cwt.; 2½ cwt. superphosphate and 2½ cwt. steam bone flour, 17 tons 4 cwt.; and 2½ cwt. superphosphate and 5½ cwt. ground mineral phosphate, 16 tons 13 cwt.

Varieties of Swedes (*N. of Scotland Coll. of Agric., Leaflet No.* 51).—Varieties of swedes, grown at three different centres, gave the following yields per acre:—*Centre I.*—Smith's Best of All, 19 tons 15 cwt.; Garton's Superlative, 19 tons 9 cwt.; Smith's Aberdeen Prize Purple Top, 18 tons 17 cwt.; Laird and Sinclair's Waverley, 18 tons 6 cwt.; and Driffield's Pioneer, 16 tons 3 cwt. *Centre II.*—Smith's Best of All, 16 tons 17 cwt.; Garton's Superlative, 16 tons 8 cwt.; Webb's Empire Swede, 16 tons; Webb's Premier Swede, 14 ton 15 cwt.; and Smith's Aberdeen Prize Purple Top, 11 tons 5 cwt. *Centre III.*—Inverquhomery Swede, 23 tons 11 cwt.; Carter's Holborn Invicta, 23 tons 5 cwt.; Hunter's Ne plus Ultra, 22 tons 3 cwt.; and Brydon's Darlington Swede, 20 tons. Inverquhomery Swede is one of exceptional quality containing a high percentage of dry matter. Brydon's Darlington Swede was somewhat soft, and was badly attacked by finger-and-toe.

Varieties of Early Culinary Peas (*E. Sussex Educ. Com. Agric. Educ, Sub-Com.*—The seeds were sown on 4th April in drills 2 ft. 9 in. apart on a shallow loam, sub-soil clayey loam and chalk. The varieties were tried for their suitability for allotment and small holders having land in exposed situations. The weights in pod in lb. per 100 ft. length of row were as follows (leading varieties only): Union Jack 92, Rentpayer 90, Lincoln 86, Senator 86, The Daisy 72, Dwarf Defiance 71, Thomas Lacton 65, Marvellous 65, Lacton's Superb 63, King Edward VII. 63.

Varieties and Manuring of Oats (*Summary of experiment carried out by Mr. Percy Dudding, Shrubland Park Estate Office, Baylham House, nr. Ipswich*).—Four varieties of oats were tested on poor light land, and each variety was treated with seven different dressings of artificials. Averaging the manurial results so as to eliminate the factor of manures, the results were (per acre): Waverley, 24 bush. grain, 20 cwt. straw; Abundance, 23 bush. grain, 17 cwt. straw; Record, 23 bush. grain, 19 cwt. straw; Tartar King, 18½ bush. grain, 15 cwt. straw.

Averaging variety results, so as to eliminate the factor of varieties, the results from the various manurial dressings were (per acre):—

Dressing.	*Cost in 1916.* £ s. d.	*Average Yield.* *Grain.* bush.	*Straw.* cwt.
5 cwt. Pure dissolved bones ...	2 0 0	18½	13
15 „ Ground lime	1 6 3	15	12
2 „ Superphosphate ... 15 „ Ground lime ... 1½ „ Nitrate of soda ...	3 0 11	25	23
2 „ Superphosphate ... 15 „ Ground lime ...	1 15 1	20½	16
2 „ Superphosphate ... 1 „ Sulphate of ammonia ...	1 5 10	24½	19
2 „ Superphosphate ... 1½ „ Nitrate of soda ...	1 10 5	27	23
1½ „ Nitrate of soda	1 1 7	26	21
No manure	—	19	16

Eradication of Moss from a Meadow (*Zemledjeltcheskaja Gazeta*, No. 42, 1916).—Deep ploughing with a two-horse plough was carried out in September, and the field left to the effects of the winter. As soon as possible in spring, when the ground had dried, the field was harrowed lengthwise and across with a heavy harrow, and oats were sown. After harvesting the oats, dung was spread on the stubble, ploughed in, and rye was sown. After harvesting the rye, the stubble was ploughed and the field left until the spring of the third year, when the soil was very friable and soft and free from moss. The field was then sown down with a mixture of clover and timothy, and after four years remained permanently meadow, no moss having since appeared. No recourse was had during treatment to burning.

Improvement of Upland Pastures (*Univ. Coll. of Wales; A. E. Jones, B.Sc., and R. G. Stapledon, M.A.*).—Approximately one-third of the land devoted to agriculture in the counties of Brecon, Cardigan, Carmarthen, Merioneth, Montgomery, Pembroke and Radnor together is at present only used as mountain and hill grazing. This bulletin deals not with the possibility of again bringing a considerable proportion of this land under cultivation, but with the improvement of the grazing itself without resort to extensive drainage or other costly operations.

The practical conclusions drawn from the data presented are as follows:—

(1) On many areas regular burning, surface drainage and irrigation, and, in some instances, surface cultivation should be first adopted, and subsequently top-dressings and sometimes renovating mixtures resorted to.

(2) The system of farming should be arranged so as to utilise the following facts to the utmost: Phosphate manures and lime exert a favourable influence on the leguminous herbage and tend, therefore, to react advantageously on the fertility of mountain and heath land which includes such plants. The feeding value of the herbage is in-

creased, and grazing animals congregate upon improved areas. Provided that adequate arrangements are made to supply water, mountain sheep would seem to do as well when confined to a comparatively small enclosure as when they have access to the whole walk. The effect of grazing animals congregating on relatively small areas is to maintain the quality of the herbage. Sheltered slopes offer the most favourable grazing grounds for sheep and also tend to produce the best herbage.

Certain modifications in local practice are suggested. It is emphasised that: (1) all improvements carried out on hill land should be conducted in conjunction with adequate fencing in order that the improved grazing may be under control; (2) that substantial improvements will never result as long as land is broken and put under a long rotation of chiefly corn, with the addition of but little or no manures, and then put down to grass. It is probably far more economical first to obtain an improved herbage either by top-dressings only, or by resort to (*a*) short rotations of chiefly crops folded on the land, or (*b*) shallow cultivations and renovating mixtures in addition, and ultimately, if so desired, to bring the improved field into the regular rotation; (3) that, by the judicious planting of shelter belts it would be possible to bring a larger number of improved areas under permanent cultivation.

MISCELLANEOUS NOTES.

The Position of the German Stock Feeder.—The German Agricultura Council has published a notice headed "What may the Farmer Feed, and What may he not Feed?"

Notes on Agriculture Abroad.

From 1st January, 1917, onwards the German farmer must not feed to his stock:—

1. Bread corn, rye, wheat, spelt, meslin from bread corn and other corn, meal and bread from bread corn.
2. Barley, if it forms part of the 60 per cent. of the harvest that the farmer has to give up.
3. Oats, meslin from oats with other corn or with legumes, above such quantities as are allowable in feeding (see below).
4. Buckwheat and millet.
5. Peas, beans, lentils.
6. Potatoes, potato starch, potato starch meal, dried potato products.
7. Sugar beets (individual exceptions allowed).
8. Cabbage (except when unfit for human consumption and if allowed by the Vegetable and Fruit Office).
9. Beechnuts (exceptions allowed).
10. Whole milk.

The German farmer may feed to his stock:—

1. Bran from corn.
2. 40 per cent. of the barley harvest, but it must be crushed.
3. Oats, alone or in mixture, until 31st May, 1917, to a horse (or soliped) 750 lb. (*i.e.*, 5 lb. per head per day), to a breeding bull with permission of the authorities, 1 lb. per head per day.
4. Soya beans, pea pods and bran; and peas, beans, legumes, when certified by the Imperial Legumes Office to be unfit for human consumption.
5. Mangolds, turnips, carrots, kale. Cabbage and swedes only with permission of the authorities, and to not more than one two-hundredths of the total farmer's stock per day.
6. Sugar beet leaves and slices.
7. Potatoes, if not sound or below 1 in. in size, to pigs and poultry (to other animals only if impossible to feed pigs or poultry on them).
8. Hay, straw, chop, chaff.
9. Whole milk only to calves and pigs under six weeks.
10. All other unnamed feeding stuffs not prohibited in above lists. (*Deutscher Reichsanzeiger*, 3rd January, 1916).

Proposed Agricultural Bank in Finland.—H. M. Consul at Helsingfors reports that it is intended to establish in Tammerfors a new bank, called the Agricultural Joint Stock Bank in Finland, with a share capital of 5,000,000 Finnish marks (=£200,000 at par), and having as its object the granting of loans to small farmers, parish councils, etc., with a view to promoting agriculture by assisting in the purchase of implements and other agricultural requirements. (*Board of Trade Journal*, 11th January, 1917.)

Production of Potash from Seaweed and Alunite in the United States.—According to the New York *Journal of Commerce* of 24th November, a plant on a commercial scale is to be set up by the United States Department of Agriculture for the conduct of experimental work on the production of potash from seaweed, an appropriation of 175,000 dols. (about £36,000) having been made for this purpose. It is expected that the plant will be established in Southern California, either at Santa Barbara or Long Beach, and that constructive work will be begun soon after the site has been decided upon.

The plans are for a plant capable of dealing with approximately 200 tons of wet seaweed per day. The equipment will consist of drying kilns, distilling chambers, vats, handling machinery, etc. Electric power will probably be used for all mechanical operations, while heat for drying and distillation will be furnished by the use of crude petroleum. From the 200 tons of seaweed treated daily about 5 tons of muriate of potash will be manufactured.

The primary purpose of the plant will be to determine the most economical processes for producing potash from seaweed and to work out methods for the recovery and utilisation of by-products. Numerous methods will be employed experimentally, but for the most part the Department of Agriculture will rely on distillation processes.

In this connection it may be of interest to note that, according to *Commerce Reports* (Washington) of 12th June, 1915, the area of the seaweed beds along the United States Pacific coast is nearly 400 square miles. From this area, it is officially estimated, the annual cuttings, including two cuttings per annum off the coast of south western California, would yield 59,000,000 tons of seaweed, from which 2,300,000 tons of potassium chloride could be produced. (*Board of Trade Journal*, 14th December, 1916.)

In a recent bulletin (No. 415) of the United States Bureau of Soils, discussing the recovery of potash from alunite, the conclusion is reached that the immediate exploitation of the alunite deposits in Central Utah should prove both practicable and profitable.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural and Commercial Statistics* for January, 1917, issued by the International Institute of Agriculture, contains particulars concerning the production of cereal crops in 1916. The countries for which data are available are as follows :—In *Europe*—Denmark, Spain, France, Great Britain, Ireland, Italy, Norway, Netherlands, Rumania, Russia in Europe (48 Governments), Switzerland ; in *America*—Canada, United States ; in *Asia*—British India, Japan ; in *Africa*—Egypt, Tunis.

Wheat.—The total production in the above-mentioned countries is estimated at 317,319,000 qr. in 1916, compared with 421,052,000 qr. in 1915, a decrease of 24·6 per cent.

Rye.—In the specified countries, excluding Great Britain, Rumania, British India, Japan, Egypt, and Tunis, the total production is placed at 115,441,000 qr. in 1916, against 121,707,000 qr. in 1915, a reduction of 5·1 per cent.

Barley.—In the above-named countries, excluding British India, the production is estimated to amount to 124,102,000 qr. in 1916, against 135,519,000 qr. in 1915, or a decrease of 8·4 per cent.

Oats.—The total production in the above-mentioned countries, with the exception of British India, Japan, and Egypt, is estimated at 325,198,000 qr. in 1916, or a reduction of 13·4 per cent. compared with the previous year, when it amounted to 375,361,000 qr.

Maize.—In Italy, Russia in Europe (48 Governments), Switzerland, Canada, United States, and Japan, the production is placed at 320,099,000 qr. in 1916, compared with 374,790,000 qr. in 1915, the decrease being equal to 14·6 per cent.

France.—The Ministry of Agriculture estimates the area sown with winter grain this season as follows (with comparison for 1915–16 in brackets): wheat, 10,564,165 acres (12,435,240 acres); rye, 2,044,765 acres (2,274,808 acres); oats, 1,606,957 acres (1,691,901 acres); and barley, 270,132 acres (246,333 acres). The condition of the crops on 1st February, 1917, was as follows (1st February, 1916, in brackets):—wheat, 60 (70); rye, 67 (72); oats, 66 (72); and barley, 67 (73). (60 = fairly good, 80 = good.) (*London Grain, Seed and Oil Reporter*, 3rd and 16th February.)

Russia.—The production of the chief crops in 1916 in 48 Governments is officially estimated as follows (the figures in brackets are the average of the years 1909-13): rye, 88,600,000 qr. (86,600,000); wheat, 51,200,000 qr. (69,986,000); oats, 80,200,000 qr. (88,893,000); and barley, 38,900,000 qr. (45,827,000). The production in Siberia is as follows: rye, 3,800,000 qr. (3,500,000); wheat, 14,000,000 qr. (10,600,000); oats, 13,900,000 qr. (10,200,000); and barley, 1,100,000 qr. (990,000). (*Broomhall's Corn Trade News*, 2nd February.)

Canada.—The production of the principal crops in 1916 is now estimated by the Census and Statistics Office, Ottawa, as follows: wheat, 220,367,000 bush. as compared with 376,303,600 bush. in 1915; oats, 351,174,000 bush. against 520,103,000 bush.; barley, 41,318,000 bush. against 53,331,300 bush.; and linseed, 7,122,300 bush. against 10,628,000 bush. last year. (*High Commissioner's Report*, 25th January.)

India.—The First Wheat Forecast issued by the Department of Statistics, Calcutta, estimates the area sown with wheat up to the beginning of December, 1916, at 30,924,000 acres as compared with 28,535,000 acres at the same date last year. The sowing season has been favourable on the whole, although operations were impeded by excessive rain in some provinces. The condition of the young crop is generally good.

New Zealand.—According to an official bulletin dated 1st November, 1916, the area sown with wheat in 1916-17 is estimated at 218,877 acres as compared with 335,423 acres, the area harvested in 1915-16; and oats, 548,526 acres, against 640,227 acres harvested last season.

AGRICULTURAL RETURNS OF THE UNITED KINGDOM,* 1916.

ACREAGE AND PRODUCTION OF CROPS.

Crops.	Acreage.		Produce.**		Yield per acre.		Average Yield per acre of 10 years, 1906-15.
	1916.	1915.	1916.	1915.	1916.	1915.	
Total Area (excluding Water)	Acres. 76,455,346		—		—		—
Total Acreage of Crops and Grass†	46,563,867	46,554,185	—		—		—
Arable Land	19,405,076	19,254,512	—		—		—
Permanent Grass :—			Tons.	Tons.	Cwts.	Cwts.	Cwts.
For Hay	6,521,195	6,393,365	9,710,503	7,922,591	29·78	24·78	27·91
Not for Hay ..	20,637,596	20,906,308	—	—	—	—	—
Total.. ..	27,158,791	27,299,673	—	—	—	—	—
			Quarters.	Quarters.	Bshls.	Bshls.	Bshls.
Wheat	2,051,729	2,333,354	7,471,884	9,239,355	29·13	31·68	32·21
Barley or Bere	1,651.878	1,522,654	6,612,550	5,862,244	32·02	30·80	34·04
Oats	4,148,856	4,159,312	21,333,782	22,308,395	41·16	42·91	42·38
Rye	65,829	59,934	—	—	—	—	—
Beans‡	242,695	272,929	892,572	924,155	30·38	28·00	30·13
Peas‡	113,422	130,226	261,090	300,338	24·41	24·38	26·33
			Tons.	Tons.	Tons.	Tons.	Tons.
Potatoes..	1,144,375	1,202,259	5,468,881	7,540,240	4·78	6·27	5·77
Turnips and Swedes ..	1,615,293	1,617,973	23,318,170	24,431,083	14·49	15·13	14·65
Mangold	460,918	498,954	9,009,752	9,696,499	19·60	19·48	19·37
Cabbage, Kohl-rabi and Rape	182,458	183,844	—	—	—	—	—
Vetches or Tares§ ..	102,434	123,389	—	—	—	—	—
			Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Hops	31,352	34,744	307,856	254,609	9·82	7·33	9·05
Small Fruit¶	95,923	97,126	—	—	—	—	—
Clover and Rotation Grasses :—			Tons.	Tons.			
For Hay	3,053,070	2,837,030	5,487,869	4,526,192	35·95	31·91	32·02
Not for Hay ..	3,667,475	3,583,943	—	—	—	—	—
Total ..	6,720,545	6,420,973	—	—	—	—	—
Other Crops	349,288	280,228	—	—	—	—	—
Bare Fallow	430,081	316,613	—	—	—	—	—

LIVE STOCK.

—	1916.	1915.
	No.	No.
Horses used for Agricultural purposes (including Mares kept for Breeding) ..	1,288,504	1,217,880
Unbroken Horses, including Stallions — One year and above ..	345,525	319,159
Unbroken Horses, including Stallions — Under one year ..	191,748	166,581
Total Horses.. ..	1,825,777	1,703,620
Cows and Heifers in Milk or in Calf ..	4,482,155	4,476,788
Other Cattle — Two years and above ..	2,341,395	2,218,246
Other Cattle — One year and under two ..	2,792,191	2,656,053
Other Cattle — Under one year ..	2,796,855	2,780,795
Total Cattle	12,412,596	12,131,882
Ewes kept for Breeding ..	11,569,887	11,308,451
Other Sheep — One year and above ..	5,570,992	5,390,746
Other Sheep — Under one year ..	11,630,818	11,499,245
Total Sheep	28,770,698	28,198,442
Sows kept for Breeding ..	432,831	437,828
Other Pigs ..	3,171,789	3,346,505
Total Pigs	3,604,620	3,784,333

* Exclusive of the Isle of Man and Channel Islands, where no produce statistics are collected. ** The figures of Produce for Ireland are subject to revision. † Exclusive of mountain and heath land used for grazing. ‡ Figures include acreage but not produce of areas picked or cut green, except in the case of beans in Scotland, where the acreage picked or cut green is excluded. § Figures for Scotland [illegible]

Agricultural Conditions in England and Wales on 1st February.

THE Crop Reporters of the Board, in reporting on the agricultural position on 1st February, state that the cold weather prevailing throughout nearly the whole of January hindered all cultivation of the land and wheat sowing, although some little progress was made early in the month. The hard state of the ground, however, enabled farmers to cart manure. Early-sown wheat looks well, although it has been everywhere somewhat cut by the keen winds and frosts; but that sown late is generally a poor plant, and much of it is still not yet showing above ground. Winter oats are generally a stronger plant than wheat, and have stood the severe conditions better; while beans are generally satisfactory.

Ewes have done fairly well considering the hard weather, but much hand-feeding has been necessary. Lambing prospects are considered quite favourable, and the early flocks of Dorsetshire and neighbouring counties have given satisfactory results; there are, perhaps, not quite so many twins as usual, but the lambs appear to be healthy.

Live stock have done fairly well, except in the hilly districts where deep snow has rendered the conditions difficult. Considerable inroads have been made into the supplies of roots and hay; but there appears to be sufficient keep for the rest of the winter, apart from a few localities where turnips are beginning to get scarce.

Agricultural Labour in England and Wales during January.

Northumberland, Durham, Cumberland and Westmorland.—With little work on the land possible during January the labour question was not acute, but farms were much understaffed and great difficulty in the spring was anticipated, as work was very backward.

Lancashire and Cheshire.—Labour was everywhere scarce, but the deficiency was not so much felt owing to the severe weather interrupting work on the land.

Yorkshire.—The supply of horsemen was very short and all classes of workers were scarce.

Shropshire and Stafford.—The shortage was acute, and practically no labour was obtainable.

Derby, Nottingham, Leicester, and Rutland.—The supply of labour was short and difficulty was anticipated in getting the spring corn sown.

Lincoln and Norfolk.—The supply of labour continued to be very short, and apprehensions were felt as to the amount of necessary work which will be neglected when the weather improves.

Suffolk, Cambridge, and Huntingdon.—With little work on the land possible during January the scarcity of labour was not much felt, but farmers had very few workers, and when open weather comes a great deficiency will be apparent.

Bedford, Northampton, and Warwick.—The supply of labour was very deficient and the shortage seemed to be most acute in Bedfordshire.

Buckingham, Oxford, and Berkshire.—The supply of labour was seriously short, and farm work was backward in consequence. Experienced hands were urgently needed.

Worcester, Hereford, and Gloucester.—A deficiency of labour was reported from every district, and it was anticipated that there will be great difficulty in getting the spring work done. Wages showed a tendency to increase.

Cornwall, Devon, and Somerset.—The supply of labour was generally

Dorset, Wiltshire, and Hampshire.—The supply of labour was generally deficient, and there was a difficulty in obtaining skilled hands for the live stock and for threshing.

Surrey, Kent, and Sussex.—The supply of skilled workers was very deficient, and it was anticipated that a serious shortage will be revealed when the weather improves.

Essex, Hertford, and Middlesex.—The supply of labour was very deficient, casual labour was difficult to obtain, and it was expected that the shortage will be keenly felt when field work can again be begun.

North Wales.—The supply was insufficient in most districts, but the shortage will be more severely felt when the weather improves.

Mid Wales.—The supply was abnormally short and prospects were very unfavourable for the future.

South Wales.—The supply of labour was getting more deficient, but little field work, except manure carting, had been possible during January. Work was very backward, however, and with open weather the shortage will be much felt.

The Weather in England during January.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 6th Jan.:								
England, N.E. ...	44·7	+6·8	0·17	4	− 9	2	1·7	+0·7
England, E.	45·3	+7·5	0·28	7	− 6	4	1·7	−0·3
Midland Counties ...	45·1	+7·3	0·32	8	− 7	4	1·0	−0·1
England, S.E. ...	46·0	+6·4	0·26	7	− 7	2	1·6	+0·2
England, N.W. ...	45·8	+6·4	0·94	24	+ 5	6	0·7	−0·3
England, S.W. ...	46·2	+4·8	0·41	10	− 13	4	1·4	−0·1
English Channel ...	48·7	+3·9	0·42	11	− 9	5	1·8	−0·2
Week ending 13th Jan.:								
England, N.E. ...	35·4	−2·3	1·71	43	+33	7	0·6	−0·4
England, E.	35·6	−1·6	1·10	28	+18	7	1·0	−0·4
Midland Counties ...	35·6	−1·4	1·33	34	+23	6	0·8	−0·4
England, S.E. ...	37·0	−1·8	0·96	24	+12	6	1·0	−0·4
England, N.W. ...	37·2	−1·8	1·20	30	+15	5	0·8	−0·2
England, S.W. ...	39·0	−1·4	1.16	29	+10	6	1·7	+0·2
English Channel ...	42·2	−1·6	1·35	34	+16	6	1·2	−0·7
Week ending 20th Jan.:								
England, N.E. ...	34·1	−4·1	0·92	24	+16	7	0·2	−0·9
England, E.	33·8	−3·9	0·34	9	0	6	0·4	−1·0
Midland Counties ...	32·5	−5·4	0·20	5	− 5	4	0·2	−1·2
England, S.E. ...	34·1	−5·2	0·18	5	− 7	4	0·3	−1·2
England, N.W. ...	33·9	−5·5	0·13	4	−12	3	0·7	−0·6
England, S.W. ...	33·4	−7·5	0·07	2	−16	1	2·4	+0·8
English Channel ...	37·7	−6·4	0·20	5	− 9	4	1·1	−0·9
Week ending 27th Jan.:								
England, N.E. ...	32·7	−5·7	0·06	2	− 7	3	0·1	−1·6
England, E.	30·7	−7·5	0·02	1	− 8	1	0·3	−1·8
Midland Counties ...	29·6	−8·8	0·02	1	−11	2	0·2	−1·4
England, S.E. ...	30·7	−8·8	0·01	0	−12	1	1·7	−0·2
England, N.W. ...	31·4	−8·2	0·00	0	−18	0	1·0	−0·6
England, S.W. ...	31·1	−10·0	0·02	1	− 20	1	0·7	−1·1
English Channel	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in January, 1917, and December, 1916.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	January.		December.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	17 0	15 6	15 6	14 5
Herefords	16 4	15 3	15 1	13 11
Shorthorns	16 2	14 9	14 10	13 7
Devons	16 0	14 6	14 7	13 4
Welsh Runts	16 11	15 7	14 10	13 11
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	—	—	—	—
Sheep :—				
Downs	15	13¾	14½	13
Longwools	14	13	13½	12½
Cheviots	15	13¾	14½	13¼
Blackfaced	14¼	13¼	14	12¾
Welsh	14	12¾	13½	12½
Cross-breds	14½	13½	14¼	13¼
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	13 9	12 11	13 3	12 4
Porkers	14 8	14 0	14 5	13 9
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	41 10	33 11	40 7	32 4
,, —Calvers ...	38 17	31 6	37 15	30 10
Other Breeds—In Milk ...	41 12	32 8	38 12	30 3
,, —Calvers ...	28 0	26 0	27 0	25 10
Calves for Rearing	3 7	2 13	3 9	2 12
Store Cattle :—				
Shorthorns—Yearlings ...	15 14	13 18	15 9	13 10
,, —Two-year-olds...	24 8	21 4	22 16	19 18
,, —Three-year-olds	31 6	26 6	31 1	26 2
Herefords —Two-year-olds...	27 12	22 14	23 10	21 2
Devons— ,,	25 0	21 10	24 2	20 7
Welsh Runts— ,,	—	—	22 5	19 1
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	70 7	58 8	62 0	52 9
Store Pigs :—				
8 to 12 weeks old	26 7	19 6	24 0	16 5
12 to 16 ,, ,, ...	46 8	36 10	42 7	31 10

* Estimated carcass weight.

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in ENGLAND in January, 1917.

(Compiled from Reports received from the Board's Market Reporters).

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—											
English	1st	111	6	113	0	—		115	6	113	6
	2nd	106	6	108	6	—		109	0	109	0
Cow and Bull	*1st*	*104*	*0*	*107*	*0*	94	0	*96*	*0*	*100*	*6*
	2nd	96	0	100	6	83	6	91	0	91	0
Irish: Port Killed	1st	109	6	109	6	109	6	113	6	111	0
	2nd	105	0	105	0	102	6	107	0	105	6
Argentine Frozen—											
Hind Quarters	1st	—		—		—		—		—	
Fore ,, ...	1st	—		—		—		—		—	
Argentine Chilled—											
Hind Quarters	1st	99	0	98	0	101	6	100	6	101	6
Fore ,, ...	1st	82	0	80	6	84	0	84	0	84	0
American Chilled—											
Hind Quarters	1st	—		—		—		103	6	—	
Fore ,, ...	1st	—		—		—		83	6	—	
VEAL:—											
British	1st	114	0	112	0	112	0	124	0	—	
	2nd	103	6	102	6	96	0	105	6	95	6
Foreign...	1st	—		—		—		—		—	
MUTTON:—											
Scotch	1st	126	0	126	0	125	0	120	0	128	0
	2nd	120	6	116	6	111	0	111	0	118	6
English...	1st	127	0	128	0	—		115	6	121	6
	2nd	122	6	118	6	—		106	0	114	0
Irish: Port Killed	1st	124	0	—		118	0	107	6	116	6
	2nd	115	6	—		109	6	98	0	110	0
Dutch	1st	—		—		—		99	6	—	
Argentine Frozen	1st	86	6	85	6	86	0	88	0	86	0
New Zealand ,, ...	1st	82	6	85	6	81	6	84	6	81	6
LAMB:—											
British	1st	—		—		—		—		—	
	2nd	—		—		—		—		—	
New Zealand	1st	96	6	97	0	95	0	95	0	95	0
Australian	1st	100	6	—		—		94	0	—	
Argentine	1st	95	6	100	6	94	6	98	0	94	6
PORK:—											
British	1st	132	6	132	6	125	0	119	6	122	6
	2nd	123	0	121	6	112	0	107	6	111	0
Frozen	1st	98	0	95	0	97	6	96	0	95	6

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in January, 1917.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	25 0	24 0	—	—	23 6	22 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	219 0	215 0	—	—	—	—
„ Factory	193 0	189 0	—	—	—	—
Danish...	—	—	220 0	217 6	219 6	217 6
French...	—	—	—	—	212 0	207 6
Dutch	—	—	—	—	205 6	201 6
American	194 6	190 6	193 6	189 6	192 6	188 6
Australian	207 6	205 0	205 6	202 6	203 0	197 0
New Zealand	211 6	209 6	211 6	209 0	207 0	202 0
Argentine	—	—	204 6	202 0	201 0	195 6
CHEESE ;—						
British—						
Cheddar	141 6	135 0	140 6	135 0	145 0	138 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	162 0	157 0	162 6	156 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	140 0	136 6	139 0	136 6	140 6	136 6
BACON ;—						
Irish (Green)	129 0	122 0	126 0	122 0	126 0	122 0
Canadian (Green sides)	114 0	112 0	114 0	109 6	114 6	108 6
HAMS ;—						
York (Dried or Smoked)	171 0	166 0	—	—	173 0	167 0
Irish (Dried or Smoked)	—	—	—	—	161 0	155 0
American (Green) (long cut)	104 6	100 6	104 6	100 6	106 6	102 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	—	—	—	—	29 2	26 10
Irish	27 0	—	27 0	25 5	27 7	26 0
American	18 2	—	17 1	16 4	18 0	16 8
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	252 0	232 0	—	—	242 0	230 0
Edward VII.	267 6	250 0	241 6	231 6	245 6	234 6
Up-to-Date	258 6	240 6	230 0	218 6	235 0	225 0
HAY ;—						
Clover	—	—	150 0	140 0	142 6	133 6
Meadow	—	—	—	—	142 6	133 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1915, 1916 and 1917.

Weeks ended (*in* 1917).	WHEAT.			BARLEY.			OATS.		
	1915.	1916.	1917.	1915.	1916.	1917.	1915.	1916.	1917.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 6...	46 2	55 8	76 0	29 7	47 8	66 4	26 5	31 5	47 1
,, 13...	48 9	56 7	75 8	30 5	48 6	65 7	27 6	31 11	47 2
,, 20...	51 6	57 2	75 8	31 3	49 6	64 9	28 10	32 6	47 4
,, 27...	52 8	58 0	75 10	32 5	51 0	64 5	29 10	32 11	47 8
Feb. 3...	53 3	58 3	75 10	33 7	52 5	64 0	30 3	32 4	47 3
,, 10...	54 8	57 6	76 0	34 7	52 10	63 5	31 1	32 2	46 11
,, 17...	56 0	56 11	76 3	34 11	53 6	63 8	31 5	31 9	47 3
,, 24...	56 0	58 2		35 3	54 2		31 8	32 2	
Mar. 3...	55 11	59 4		34 6	55 7		31 8	32 4	
,, 10...	54 8	58 2		33 5	55 6		31 0	32 3	
,, 17...	53 9	57 9		32 2	55 4		30 7	31 10	
,, 24...	54 3	55 11		31 11	54 6		30 6	31 4	
,, 31...	54 6	53 6		31 9	53 8		30 6	30 5	
Apl. 7...	54 9	51 8		31 3	53 7		30 4	30 1	
,, 14...	55 4	53 2		30 10	53 1		30 5	30 7	
,, 21...	56 5	55 3		31 5	52 10		30 11	31 8	
,, 28...	58 3	56 3		32 7	53 5		31 5	32 4	
May 5...	60 5	55 7		33 3	53 1		32 4	32 10	
,, 12...	61 7	55 5		34 0	53 5		32 5	33 1	
,, 19...	62 0	55 0		34 1	52 10		32 8	33 0	
,, 26...	61 11	54 7		34 8	52 9		32 7	33 4	
June 2...	61 9	53 3		35 4	53 9		32 5	33 3	
,, 9...	60 1	51 2		34 5	52 8		32 4	32 7	
,, 16...	56 1	48 10		34 3	50 9		31 9	32 1	
,, 23...	52 0	47 6		34 4	49 10		31 9	31 3	
,, 30...	49 5	46 3		35 3	49 1		31 1	30 10	
July 7...	50 1	46 3		34 7	45 6		31 6	30 8	
,, 14...	52 7	48 11		35 8	47 5		31 6	31 6	
,, 21...	53 10	51 6		35 10	48 8		32 1	32 3	
,, 28...	55 3	53 5		36 1	47 2		31 1	32 5	
Aug. 4...	55 4	55 1		35 7	46 1		31 5	32 9	
,, 11...	55 2	56 7		37 0	46 11		31 7	31 2	
,, 18...	54 3	58 1		39 4	48 0		31 4	30 8	
,, 25...	51 11	59 0		38 3	47 1		30 0	31 6	
Sept. 1...	45 3	59 4		38 1	48 5		26 10	30 5	
,, 8...	43 0	59 3		37 11	51 7		26 8	31 1	
,, 15...	42 9	59 11		39 0	52 6		26 4	30 9	
,, 22...	43 3	59 4		39 8	53 3		26 1	30 9	
,, 29...	43 5	58 10		40 4	54 1		26 5	31 1	
Oct 6...	44 1	59 2		41 0	54 5		26 5	30 9	
,, 13...	45 9	59 7		42 3	53 10		27 1	31 6	
,, 20...	48 2	60 9		44 0	53 8		28 1	31 11	
,, 27...	50 3	62 10		46 2	54 6		29 1	32 10	
Nov. 3...	51 6	66 7		47 3	56 2		30 4	34 0	
,, 10...	52 8	69 8		47 5	58 0		30 11	35 8	
,, 17...	53 6	70 9		47 11	59 8		31 3	37 8	
,, 24...	54 2	70 8		48 7	61 8		31 1	39 7	
Dec. 1...	53 7	71 3		48 11	63 1		30 11	41 4	
,, 8...	52 10	72 1		47 10	65 6		30 4	44 1	
,, 15...	53 11	73 2		47 5	66 5		30 6	45 10	
,, 22...	53 10	74 8		47 2	67 3		30 7	46 5	
,, 29...	54 9	75 10		47 5	67 5		30 10	47 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of January, 1915, 1916, and 1917.

—	Wheat.			Barley.			Oats.		
	1915.	1916.	1917.	1915.	1916.	1917.	1915.	1916.	1917.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	51 0	58 2	76 1	32 6	47 0	65 0	29 11	33 3	47 5
Norwich ...	47 6	55 6	74 1	30 2	48 6	63 11	28 0	32 7	47 3
Peterborough	49 4	56 6	74 10	30 11	48 3	64 9	28 7	32 2	47 0
Lincoln ...	49 5	57 3	76 8	30 3	49 8	66 6	27 6	31 9	48 1
Doncaster ...	49 1	57 4	75 8	30 0	49 3	65 10	27 2	31 8	47 4
Salisbury ...	48 11	56 6	75 2	31 1	50 2	64 10	29 0	33 2	46 8

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on 1st February, 1917, certain diseases of animals existed in the countries specified :—

Austria (on the 10th January).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Denmark (month of December).—Anthrax, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

France (for the period 17th December—6th January).—Anthrax, Black-leg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Swine Erysipelas, Swine Fever.

Germany (for the period 1st—15th January).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (month of December).—Anthrax, Foot-and-Mouth Disease, Foot-rot, Swine Erysipelas.

Hungary (on the 10th January).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 1st—7th January).—Anthrax, Black-leg, Foot-and-Mouth Disease (1,258 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of December).—Anthrax, Black-leg.

Russia (month of September).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (58,366 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of August).—Anthrax, Black-leg, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Tuberculosis.

Sweden (month of November).—Anthrax, Black-leg, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

Switzerland (for the period 8th—14th January).—Anthrax, Black-leg, Foot-and-Mouth Disease (3 "étables" entailing 25 animals, of which 3 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries: Belgium, Bulgaria, Montenegro, Rumania, Serbia.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JANUARY.	
	1917.	1916.
Anthrax :—		
Outbreaks	56	56
Animals attacked	60	58
Foot-and-Mouth Disease :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks...	2	4
Animals attacked	2	13
Parasitic Mange :—		
Outbreaks	324	389
Animals attacked	688	1,085
Sheep-Scab.—		
Outbreaks	1 [illegible]	87
Swine Fever :—		
Outbreaks	159	314
Swine Slaughtered as diseased or exposed to infection	63	1,044

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JANUARY.	
	1917.	1916.
Anthrax :—		
Outbreaks	1	1
Animals attacked	1	5
Foot-and-Mouth Disease :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks	—	—
Animals attacked	—	—
Parasitic Mange :—		
Outbreaks	5	9
Sheep-Scab :—		
Outbreaks	67	65
Swine Fever :—		
Outbreaks	12	13
Swine Slaughtered as diseased or exposed to infection	66	36

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AGRICULTURE AND THE WAR.

In his memorable speech on 23rd February in the House of Commons, in which he dealt with the Government proposals with regard to food and shipping problems, the Prime Minister made the following remarks on the position of agriculture :—

The Decline in Agriculture in the Past.—" Twenty years after the Corn Laws were abolished in this country we produced twice as much wheat as we imported. . . . Since then four or five million acres of arable land have become pasture. and about half the agricultural population—the agricultural labouring population—has emigrated to the Colonies. No doubt the State showed a lamentable indifference to the importance of the agricultural industry and to the very life of the nation, and that is a mistake which must never be repeated. No civilised country in the world spent less on agriculture, or even spent so little on agriculture, either directly or indirectly, as we did. . . . Between 70 and 80 per cent. of our staple cereal for consumption has been imported yearly, and at the present moment, I want the country to know, our food stocks are low, alarmingly low—lower than they have been within recollection. That is very largely due to the bad harvest. It is not altogether submarines. It is in the main due to our having had about the worst harvest within our recollection. Last year's crops were a failure, and that, of course, is a very serious fact when our tonnage is absorbed to such an extent by war exigencies, and when our tonnage is diminishing.

Need for Increased Production.—" It is essential, therefore, for the safety of the nation—for the maintenance of the nation, for the life of the nation—that we should put forth every effort to increase production for this year's harvest and the next, and that we should do it immediately.

"The immediate concern is this year's harvest. It would have been easier to have done it had we done it some time ago, but some of the measures we have had to take have had to be crowded into a few weeks, and I ask, when that occurs, that some measure of indulgence should be given to a man who, like the President of the Board of Agriculture, is working under very *difficult conditions* . . . and *crowding into* six weeks work that ought to have been done two years ago. . . . . There are only a few weeks in which to sow the spring wheat, the oats, the barley, and the potatoes. The *winter wheat season has gone, and it is urgently necessary* that the farmers should be induced to increase the area under cultivation at once, otherwise the nation may have to choose between diminishing its military effort and underfeeding its *population. That is the choice which Germany is taking,* the choice of giving too little food rather than to diminish its military power and strength and striking power. That is a choice we wish to avert if we possibly can in this country, *and we can do so.*

Supply of Labour.—"What is the main obstacle to inducing farmers to increase cultivation? [Hon. Members: 'Lack of labour!'] Partly lack of labour. In some counties under the voluntary system labour flocked to the Standard and farms were left derelict. Some of those are about the most important corn-producing districts in this country. There was no system. When the labourer chose to go there was no one to stop him, and there is no doubt at all that a good many districts have been depleted owing to the over-zeal and patriotism of the labourers themselves. Since the Military Service Acts there has been some discrimination exercised. At any rate, there are tribunals who have been sitting in judgment in these cases, and considering the facts placed before them. May I say, with regard to the 30,000 men called up out of the 60,000 whom the tribunals have dispensed with, only 10,000 have really been called up. If you travel across and athwart France you will find no able-bodied men of military age engaged anywhere. All the cultivators of the soil are engaged in defending that soil, and there the farmer is dependent almost entirely upon men over or under military age, upon women working on the farms, and upon substitutes.

Ploughing Up Pasture.—"But the greatest obstacle to taking immediate action to meet this exigency is the timidity of the farmer when it comes to cutting up his pasture. He has been caught twice with too much arable land, and caught

very badly—once in 1880 and the other time in 1890—and then he had years of anxiety, depression, and insolvency, his savings completely absorbed, and very often he himself for years water-logged.

"There is no memory as tenacious as that of the tiller of the soil, and the furrows are still in the agricultural mind. Those years have given the British farmer a fright of the plough, and it is no use arguing with him. You must give him confidence, otherwise he will refuse to go between the shafts. Now the plough is our hope. You must cure the farmer of his plough fright, otherwise you will not get crops. What does he say? The farmer thinks in rotations; he is not thinking merely of what will happen next year. When he is cutting up his pasture he has got to think of years ahead, otherwise he is a loser. It is no use promising him big prices for next year and then dropping him badly for the next few years. He has got before his eyes a picture of accumulated crops across the seas, ready to be dumped down in this country the moment the War is over. He says, 'Prices will break; I shall have cut up my pasture, and I shall be done for,' and he thinks of 1880 and of 1890 and what happened then, and he cannot face it again. That is the real fact. Every farmer we have appealed to has always talked in that sense, and we must get over that, otherwise he will not cut up his pasture land.

Government Guarantee of Minimum Prices and Wages.—"I do not agree myself that prices are going down immediately after the War. . . . You cannot persuade the farmer of that, and it is essential that we should get him persuaded, and persuaded within the next few days, and it is no use going on to argue with him. My right hon. Friend has done his best to persuade him, but, after all, you have got to cover a very extensive country, and, therefore, there is only one way of ensuring immediate action on the part of the farmer, and that is by guaranteeing prices for a definite period of time—minimum prices. (See also p. 1175.)

"There are two or three corollaries to a guarantee of prices The first is that if the Government guarantees prices, labour must also be guaranteed. I do not believe any farmer, looking at the prospects, can fail to see that the old wages are gone—and a good thing, not merely for the labourer, but for the farmer. The best farmers in a district are those who give the best wages. Take Scotland for example. A guarantee of minimum wages will hardly touch Scotland.

"There is no better farmer—I do not say anything about other farmers—but there is no doubt the Scottish farmer is about the best in the world.

"There is another point which the farmer must realise. The agricultural labourer has flocked to the Standard in shoals. His wife is getting a bigger separation allowance than the poor fellow earned as wages before the War, and can anyone imagine that in face of that the first thing the man will do will be to start work at a figure lower than the allowance which was thought to be the minimum which the State ought to give to keep his wife and family going? It is utterly impossible; you will not do it; you will not get the labourer back to the land unless you pay him a minimum wage, and the farmer must see that.

"There is also another fact which has brought it home to the farmer, and that is that in Mr. Neville Chamberlain's scheme for National Service a minimum wage has been fixed at 25*s.*, which is obviously applicable to the agricultural labourer, and every farmer knows that, and we propose to take that figure. We discussed for some time the question of whether you should have a Wage Board to fix wages or whether you should have a fixed minimum. That is what influenced us eventually in not setting up a Wage Board during the War. The farmer—I will not say preferred to know the worst, but he preferred to know exactly what he had to face. He did not want to be bothered with Wage Boards; he preferred to concentrate the whole of his mind on ploughing the land. After the War, Wage Boards can be set up, and the farmer will then, of course, make use of them. . . . A wage of 25*s.* per week will be guaranteed to every able-bodied male between the ages indicated in the scheme of Mr. Neville Chamberlain.

"Then comes another question. There will, of course, be disputes. I should hope there will not be many. But there may be disputes. It is obvious that when you guarantee a minimum wage of 25*s.*, old men who have been taken on and kept very much through the charity of the farmer, and whom the farmer could dispense with readily, will come into account. Such an old man might very well be worth 10*s.* or 11*s.* a week for just dawdling about the farm, and liking it, but if you say a man of that sort is to have 25*s.* a week it is the greatest unkindness you can do him. There are other similar cases of men who are not old, but who may be inefficient or crippled, but who would be able to render a little assistance about the farm.

It is obvious that cases of this kind must be exceptions. We propose during the War to adopt a rough-and-ready method similar to the machinery set up by Mr. Neville Chamberlain to decide similar questions under his scheme. . . . My right hon. Friend beside me (Mr. Balfour) reminds me that it is not merely during the War that this guarantee of a minimum wage will be given, but during the period when there will be a guarantee of prices. I will come to that period later.

The Question of Rents.—"There is a second plan. . . . . There must be a guarantee, if the State is going to guarantee a minimum price, that it shall not inure to the advantage of any individual or of any class. There must not be any return to what happened during the Napoleonic Wars. There was an enormous increase in prices, and rents were practically doubled at the end of the War. It would be obviously unfair that any class should take advantage of war conditions, and especially that they should take advantage of a guarantee by the State by which the State might lose money—should take advantage of that State guarantee to raise rents.

"Let me say at once that I have not heard of such cases. No complaints have reached the Government of anything of the kind, and in all the meetings we have had with the agricultural community no one has ever suggested that anything of the kind has happened. When, however, the House of Commons is asked to guarantee prices, I think it is entitled to have a guarantee that even in exceptional cases—cases, for instance, where estates are sold and a new owner comes into possession and proposes to raise rents—there should be some opportunity for review, and that in these cases rents shall not be raised in consequence of this guarantee of price. Of course, there are some cases where rents would have been raised even in times of peace, and even under old prices. For instance, you have the case where the old tenant has been allowed to remain for forty or fifty years at a very low rent, and it has been thoroughly understood that once there was a change of tenancy the landlord intended, and rightly intended, to put up the rent to what was just and fair between the parties. In those cases there is not going to be any interference. Another case is a rather complicated one. The tithe rent-charge has gone up enormously since the rise in prices. It is obvious that the landlord should have the right to, at any rate, adjust the rent in consequence of the rise in prices which brings better profit to the farmer himself. There have not been many cases, but the way in which we propose

to deal with these cases is to say that the landlord shall not be allowed to raise his rent except with the consent of the Board of Agriculture, so that each particular case can be examined by the Board of Agriculture to see whether there is or is not a case. Powers are to be given to the Board of Agriculture to enforce cultivation. It is obvious that it is an injustice to the community that a man should sit on land capable of producing food when he is either too selfish or too indolent to do anything. So that the Government must have the right, through the proper Department, to enforce cultivation in these cases.

Prices of Wheat, Oats and Potatoes.—I come now to the question of prices. In 1915 the price of wheat was 52*s.* 10*d.* a quarter; in 1916, 58*s.* 5*d.*; in the last quarter of 1916 it went up to 68*s.* 2*d.*; it is now 76*s.* 3*d.*"

An Hon. Member: "What was it before the War?"

The Prime Minister: Thirty-four shillings and eleven pence. Let me, however, say this, that the price of everything has gone up, and has gone up, not merely for the ordinary community, but for the farmer. The farmer has had to pay very much higher wages—and I am glad of it. He has, however, got to pay much higher prices for everything which he uses on his farm. He has got to do with less labour, and with inferior labour. I was assured by a farmer whom we consulted, and who is one of the most upright men I have ever met, and who, I am perfectly certain, would not mislead the Government, that on the prices we were guaranteeing the farmer, on the whole he would not make much out of them, having regard to all the conditions. That was, he said, the very minimum you could give him if you are going to induce him to cultivate at all. Oats in 1915, 30*s.* 2*d.*; in 1916, 33*s.* 5*d.*; last quarter, 38*s.* 4*d.*; and for the week ending the 17th February, 47*s.* 3*d.* Barley has gone up correspondingly, and potatoes, well, the House knows fairly well what the price of potatoes is. I can assure the House that I know fairly well all about the price of potatoes.

"But let me say just a word about that, because there has been a good deal of trouble about it. The moment you interfere with the price of potatoes it becomes a very difficult thing—it is the most difficult thing in the world. My hon. Friend knows very well that if we had not interfered the price was going up to £20 a ton. Potatoes had been sold at £20 a ton. Were we to allow that to be done? There is a shortage of potatoes, but that has nothing to do with the submarines.

The potato crop is raised here mostly, and the price is determined by what you have got in this country. It would have gone to almost any figure because the potato crop was a great failure here. It was a great failure in Ireland, and Ireland, instead of being a contributor to this country, had almost ceased to assist us. My right hon. Friend Lord Devonport was bound to interfere or to allow the price to get completely out of hand. Of course, the moment you begin to interfere with prices there is always a conflict, and everybody who knew nothing about it begins interfering, and here we had the usual results. My right hon. Friend was absolutely right in trying to cut down the prices, and the farmer on the other hand was equally right in trying to get as good a price as he could. At any rate the matter has been fought out, and I believe it has been substantially settled though we had not much time to settle it in. That is the position in regard to potatoes; but the great advantage has been that we have managed to keep down the prices, and, on the whole, we have managed to satisfy the farmers as well. So much for the vexed question of potatoes.

"These are the guarantees we propose to give. **We propose that in the present year we shall guarantee—**

For wheat, 60s. a quarter of 504 lb.—that is the minimum;

For 1918 and 1919, 55s.;

For 1920, 1921, and 1922, 45s. Then the guarantee comes to an end.

For oats, in 1917, we propose to guarantee 38s. 6d. per 336 lb. That is higher than the minimum price we arranged with Ireland some months ago.

The guarantee for 1918 and 1919 is 32s., and

For the next three years 24s.

Potatoes we simply propose to guarantee for this coming season at £6 per ton.

The only guarantee we have given of the maximum is this, that if the State commandeers either potatoes or cereals, the prices will not be fixed without the consent of the Boards of Agriculture of England, Scotland and Ireland, and, therefore, there will be an opportunity of consultation before the prices are fixed. Obviously, you cannot limit the power of the State to commandeer for national purposes.

I hope and trust that with this guarantee, the farmers will put their backs into it. We are having excellent reports from Scotland. In Ayrshire, Lanarkshire, Forfar and other counties, they are cutting up pasture on a very considerable scale

to sow oats and plant potatoes. Although it is very late, the farmers could increase even now by hundreds of thousands of tons the food of this country this year. And thus they can help to defeat the grimmest menace that ever threatened a country's life. I do not believe that they will fail us. Substitutes are used in every other country. Women are working now on the land, and **I hope the farmers will assist to make the best of the labour which is available. They need not apprehend that in the future the country will be indifferent to the importance of the agricultural interest to the State. The country is alive now as it has never been before to the essential value of agriculture to the community, and whatever befalls it will never again be neglected by any Government.** The War at any rate, has taught us one lesson—that the preservation of our essential industries is as important a part of the national defences as the maintenance of our Army or our Navy. So much will I say about food production."

The Prime Minister also dealt in his speech with the question of the dependence to a greater extent on home-grown meat, and remarked that the slaughter of cattle would mean a saving of feeding stuff to a considerable extent.

With regard to brewing, he stated that in 1914 there were 36,000,000 standard barrels of beer brewed in this country, and that in 1916, this quantity was reduced to 26,000,000 barrels. Early in the present year it was proposed to reduce the quantity still further—to 18,000,000 barrels. Mr. Lloyd George, however, made it clear that the quantity is to be cut down still further. "It is absolutely impossible for us to guarantee the food of this country without making a very much deeper cut into the barrelage of the country, and we must reduce it to 10,000,000 barrels. That means that you will save nearly 600,000 tons of foodstuffs per annum, and that is nearly a month's supply of cereals for this country. . . . We must have a corresponding restriction on the placing of spirits on the market."

THE FOOD PRODUCTION DEPARTMENT.

In this *Journal* for February (p. 1041) an account was given of the formation of the new Food Production Department of the Board of Agriculture and Fisheries. Sir Arthur Lee, K.C.B., M.P., has been appointed Director-General of Food Production. The structure and work of the Department have been reorganised and the higher staff considerably augmented.

The Department has been divided into four main divisions, each in charge of a Deputy Director-General, as follows :—

Divisions.	*Deputy Directors-General.*
Local Organisation ...	The Rt. Hon. Sir Ailwyn Fellowes, K.C.V.O. (unpaid).
Technical	The Rt. Hon. F. D. Acland, M.P. (unpaid).
Labour	The Hon. E. G. Strutt (unpaid).
Supplies	Mr. T. H. Middleton, C.B.

The Labour Division will also have the part-time (unpaid) services of Mr. Leslie Scott, K.C., M.P., who is graded as "Director of Labour."

Mr. E. Eustace Davies has been appointed to take charge of a new section of the Food Production Department which is to deal with all Secretarial business, and is graded as a (temporary) Assistant Secretary, Board of Agriculture.

At an interview with a number of newspaper representatives on 27th February, Sir Arthur Lee dealt with the whole question, pointing out the urgent need for increased food production, and describing certain of the steps which are being taken to overcome difficulties. The more important matters receiving immediate attention are the following :—

The development of women's labour on the land.

The provision of motor tractors, to be employed day and night, for ploughing.

Sunday work.

Improving the organisation of the War Agricultural Committees.

Arrangements for the supply of fertilisers.

The utilisation for the purposes of food production of gardeners at present privately employed.

Sir Arthur Lee remarked that it was really a question of output—the munitions business over again. The present problem was a tougher one than that of munitions. The Ministry of Munitions had more time, and they had the whole

nation to draw upon. The difficulty now was to get men, as all the men were busy.

With certain exceptions the Food Production Department needed the help and co-operation of the public, as he thought no other public department now needed them. He could not complain of the help he had got at the head, but more assistance was wanted for the organisations throughout the country.

It would have been utterly futile to have attempted a greater output if it had not been for the new agricultural policy announced by the Prime Minister. The new policy had given them the necessary impetus.

Machinery.—They had to utilise every kind of aid, natural and artificial, that could be procured, and particularly the aid of machinery. Unfortunately, the hopes of the agricultural world with regard to an enormous supply of tractors had so far been somewhat disappointed, but the difficulties of getting them from oversea under the present conditions of shipping were extremely great. He had been able to obtain the services of Mr. Perry, the managing director of the Ford Manufacturing Companies in Europe, to assist in collecting, organising, and maintaining the supply of tractors for the country. Mr. Perry, like the other people, apart from permanent officials, was giving his services gratuitously.

The problem always came back to "time." If we could get all the tractors, there was, at the most, six weeks during which they could be used.

Sunday Labour.—It was hoped to get some help from the churches. There are seven Sundays in the period during which we must act, and it was desired to get ministers of all denominations in rural districts to encourage their congregations to work on Sundays. Some words of Zoroaster are appropriate. Zoroaster, 1,000 years B.C., said: "He who sows ground with care and diligence acquires a greater stock of religious merit than he could gain by the repetition of 10,000 prayers."*

Labour Shifts.—There was another way of saving time. The ordinary ploughing day is reckoned at eight hours. Obviously horses could not be worked longer than their ordinary

* In a recent letter to the President of the Board of Agriculture the Archbishop of Canterbury states that he has no hesitation in saying that in the need which these weeks present, men and women may with a clear conscience do field-work on Sundays.—*Ed.*

period. But there is no reason why machinery should not be worked more than that time. There is the question of light, but on Sir Arthur Lee's own farms ploughing could be done with a tractor plough at night with an acetylene headlight, and if only additional shifts of labour could be arranged, ploughing could be done for 20 hours out of the 24, instead of only eight. This would mean that in the six weeks a tractor would plough 420 acres. The help of enthusiastic people was wanted in this matter. People who have been driving mechanical machinery or their own cars could help, and it was desired that they should volunteer for a corps of night ploughmen for this emergency. It would make a real difference in the situation.

Temporary and Women's Labour.—A great deal, Sir Arthur Lee said, could be done by prisoners, conscientious objectors, the Home Defence forces—temporarily—and, above all, by women. The usefulness of women in agriculture had been sadly underestimated in this country, and their help must be accepted by the farmers. A whole section of his Department was dealing with women's labour, and an elaborate scheme was now before the Treasury. Among other aid they had been offered was that of the Cavendish Association, consisting of Public School boys and masters, who will help during the holidays.

Fertilisers and Feeding Stuffs.—With regard to the supply of fertilisers and feeding stuffs, the Department had come to an ideal arrangement with the Minister of Munitions. Fertilisers were very largely a by-product of munitions, and the Ministry had realised their importance.

THE COMPOSITION AND CLASSIFICATION OF WHEAT OFFALS.

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IN writing "Notes on Feeding Stuffs," which have appeared monthly in this *Journal* since March, 1915, and in the correspondence which has arisen in connection with them, confusion has repeatedly been caused in attempting to assign an average composition to wheat offals described by local names. It has often happened, for instance, that a sample of offal sold under the name of "sharps" in one district has been found on examination to differ widely both in size of particles and in chemical composition from a sample sold under the same

name in another district. This confusion appears to be due to variation in milling practice in different districts, and to the fact that whilst the larger mills separate their offals into four grades many of the smaller mills are satisfied with a much less complicated separation.

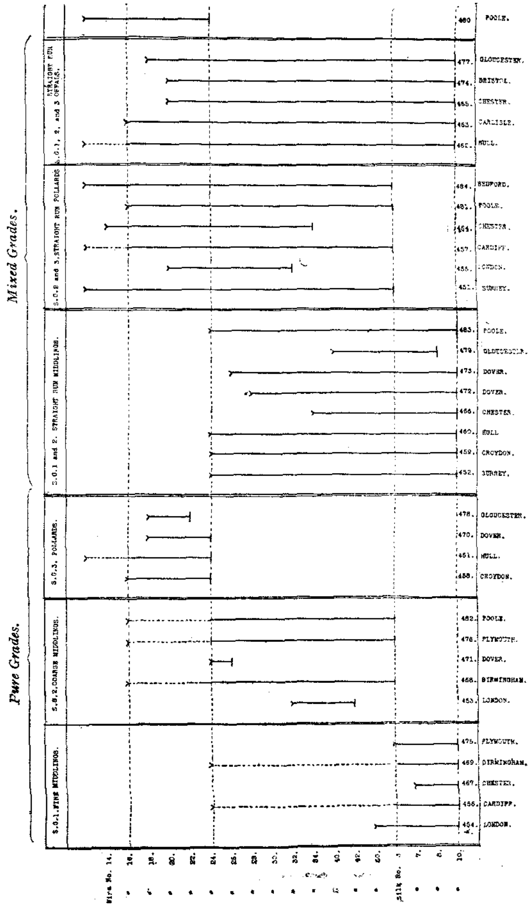
In these circumstances it was decided to make a systematic examination of a number of samples of offals with a view to clearing up the difficulty. Mr. A. E. Humphries, of the Coxes Lock Milling Company, Weybridge, very kindly undertook to collect* a number of representative samples from different districts, and to sift them so as to obtain reliable information as to size of the particles of which they were composed. The samples were analysed in the Laboratory of the Institute by Messrs. A. J. Codling and C. E. Bryant. The thanks of the Institute are due to Mr. Humphries who collected and sifted the samples, and to the millers who were good enough to send the samples at his request and to furnish particulars of the local method of naming and grading their offals.

Examination of the samples showed at once that they differed from one another in two particulars, viz., size of the particles and chemical composition. It was therefore necessary to take both these properties into account in attempting to devise a system of classification.

Before considering the results of the examination of the samples it is necessary to make a few preliminary remarks on the practice of milling. In milling, the kernels of wheat are torn apart or broken by passing between pairs of fluted rollers. The broken kernels are then reduced in size by passing between pairs of smooth or very finely fluted rollers. The flour thus formed is then sifted out through a sieve made of fine silk. The three processes are repeated several times until as much flour as possible has been separated from the wheat. Usually the *flour* includes all the particles into which the wheat has been ground which are fine enough to pass through sieves made of silk (No. 10) with 130 meshes to the linear inch.

Those portions of the wheat which will not pass through this sieve form the *offals*. Except in the case of a very small quantity of whole-meal flour, all millers take out the coarser offals under the name of bran, which is usually that part of the offals which does not pass through a wire sieve (No. 16) with about 16 meshes to the linear inch.

* The samples were collected before the first Milling Order was issued. They represent, therefore, normal offals.


Mixed Grades.
Pure Grades.
S.G.1, 2, and 3 STRAIGHT RUN OFFALS.
S.G.2 and 3, STRAIGHT RUN POLLARDS
S.G.1 and 2. STRAIGHT RUN MIDDLINGS.
S.G.3. POLLARDS.
S.S.2. COARSE MIDDLINGS.
S.G.1. FINE MIDDLINGS.
480 POOLE.
477. GLOUCESTER.
474. BRISTOL.
465. CHESTER.
463. CARLISLE.
462. HULL.
484. BEDFORD.
481. POOLE.
464. CHESTER.
457. CARDIFF.
455. LONDON.
451. SURREY.
483. POOLE.
479. GLOUCESTER.
473. DOVER.
472. DOVER.
466. CHESTER.
460. HULL.
459. CROYDON.
452. SURREY.
478. GLOUCESTER.
470. DOVER.
461. HULL.
458. CROYDON.
482. POOLE.
476. PLYMOUTH.
471. DOVER.
468. BIRMINGHAM.
453. LONDON.
475. PLYMOUTH.
469. BIRMINGHAM.
467. CHESTER.
456. CARDIFF.
454. LONDON.
Wire No. 14. 16. 18. 20. 22. 24. 26. 28. 30. 32. 34. 40. 42. 60.
Silk No. 5 7. 8. 10.

It is in the method of dealing with the offals of fineness intermediate between flour which passes through No. 10 silk sieve and bran which does not pass through No. 16 wire sieve that the variation in milling practice generally occurs. This is well shown in Diagram No. 1, which is constructed from figures supplied by the millers who sent the samples and from the results of the sifting carried out by Mr. Humphries.

A word is necessary about the method of constructing the diagram. Along the bottom of the diagram are printed the sample numbers and the place of origin of the individual samples. Each sample is represented by a vertical line with a V at the top and a horizontal line at the bottom. These marks show the limits between which the size of the particles of the samples range. The thick, black lines denote the range within which at least 75 per cent. of the particles are included—the dotted lines indicate that the sample includes a small percentage of particles coarser than the limits indicated by the black line. This means that the separation of offals has not been very accurate. The limits are defined by the figures printed at the sides of the diagram. Flour and bran are not included in the diagram, which represents only the offals intermediate between these two extreme fractions.

Inspection of the diagram shows that in the mills where the intermediate offals are most completely separated the separation falls approximately into three grades :—

Grade 1, usually called "fine middlings," which does not pass through silk sieve No. 10, but passes through silk sieve No. 3.

Grade 2, usually called "coarse middlings," which does not pass through silk sieve No. 3, but passes through wire sieve No. 24.

Grade 3, usually called "pollards," which does not pass through wire sieve No. 24, but passes through wire sieve No. 16.

In many mills, however, the offals are not so completely divided. Samples from these mills do not fall entirely in any one of these grades. Some of them are mixtures of two grades. In others practically no separation of the intermediate offals has been made, and the samples include all three grades. Such samples may be classified as follows :—

Grades 1 and 2 mixed, which may be called "straight run middlings." These samples do not pass through silk sieve No. 10, but pass through wire sieve No. 24.

Grades 2 and 3 mixed, which may be called "straight run pollards." These samples do not pass through silk sieve No. 3, but pass through wire sieve No. 16.

Grades 1, 2 and 3 mixed, which may be called "straight run offals." These samples are included between the limits of flour and bran, *i.e.*, between silk sieve No. 10 and wire sieve No. 16.

Examination of the sizes of the particles of wheat offals therefore indicates that, excluding the extreme fractions, flour and bran, offals may be classified into three "pure grades," and three "mixed grades." The following chemical analyses show that this classification has a definite value, as there is practically no overlapping in the composition of the three pure grades.

TABLE I.—*Percentage Composition of Graded Offals.*

Sample No.	Water.	Protein.	Fat.	Carbo-Hydrates.	Fibre.	Ash.	Percentage Purity.
				Grade 1.—Fine Middlings.			
454	13·09	15·29	2·95	64·37	1·89	2·41	—
456	11·41	17·09	4·34	61·55	2·38	3·23	80
457	12·39	16·76	3·16	63·08	2·16	2·45	100
459	13·35	15·31	3·69	63·36	1·94	2·35	90
475	13·43	14·29	3·06	66·65	0·93	1·64	100
Average ..	12·73	15·75	3·44	63·80	1·86	2·42	—
				Grade 2.—Coarse Middlings.			
453	13·72	17·46	5·23	55·10	5·04	3·44	100
468	14·15	16·58	5·17	55·89	4·76	3·45	80
471	11·89	15·31	4·97	57·28	6·60	3·95	100
476	13·55	17·04	5·30	54·98	5·44	3·69	85
482	13·97	15·69	4·46	57·93	4·59	3·36	90
Average ..	13·46	16·42	5·03	56·22	5·29	3·58	—
				Grade 3.—Pollards.			
458	13·25	12·98	4·42	54·88	9·61	4·86	100
461	13·15	14·04	4·54	56·57	7·42	4·28	95
470	12·44	14·96	5·01	55·17	7·79	4·63	100
478	14·43	15·58	5·09	55·37	5·97	3·56	100
Average ..	13·32	14·39	4·76	55·50	7·70	4·33	—
				Grade 4.—Bran.			
—	13·40	13·55	4·47	52·60	10·71	5·27	100
—	13·85	13·35	3·38	53·64	10·45	5·53	100
Average ..	13·63	13·45	3·92	53·12	10·58	5·40	—

The analyses in Table I. confirm the classification based on the sizes of the particles as determined by sifting, as shown in Diagram I. The composition of each grade is quite satisfactorily constant, although the individual samples were collected from widely-separated places, and the figures show, on the whole, very little overlapping, especially in the case of what may be called the characteristic constituents. Thus the characteristic of the finest grade—fine middlings—is a very high content of carbohydrates. The highest sample of the second grade—coarse middlings—contains 3 per cent. less carbohydrates than the lowest sample of fine middlings.

Coarse middlings contain much more fibre than fine middlings, and again there is no overlapping—the lowest fibre content in any sample of the former being 2 per cent. higher than the highest fibre content in the latter. The fibre content also serves to mark off pollards from coarse middlings and bran.

It is instructive to note the distribution of the various nutrients between the different grades. The percentage of carbohydrates decreases and the percentages of fibre and ash increase continuously as the size of the particles becomes larger. This is not the case with protein and fat. The percentages of these constituents are highest in the second grade—coarse middlings—and decrease as the particles become either finer or coarser than this grade. This is probably

TABLE II.—*Percentage Composition of Mixed Offals.*

Sample No.	Water.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.	Percentage Grade. 1	Percentage Grade. 2	Percentage Grade. 3	Bran.
				Grades 1 and 2 mixed.—Straight run Middlings.						
452	12·95	16·13	4·51	59·47	3·93	3·01	—	—	—	—
459	13·48	14·96	4·68	58·64	6·24	2·00	—	—	—	—
460	13·48	15·23	4·12	61·26	3·07	2·84	55	45	—	—
466	13·73	14·79	3·47	62·97	2·59	2·45	—	—	—	—
472	11·65	16·84	5·20	59·69	3·43	3·19	—	—	—	—
473	12·55	16·45	5·25	56·67	5·30	3·78	—	—	—	—
479	13·25	17·90	4·78	56·04	4·23	3·80	—	—	—	—
483	13·95	15·24	3·96	61·56	2·76	2·53	70	30	—	—
Average ..	13·13	15·95	4·50	59·54	3·94	2·94	—	—	—	—
Average Grades 1, 2	13·09	16·09	4·24	60·01	3·57	3·00	—	—	—	—
				Grades 2 and 3 mixed.—Straight run Pollards.						
451	12·65	15·60	5·07	54·18	8·18	4·32	—	15	60	25
455	13·88	17·85	5·83	51·80	6·19	4·45	—	—	—	—
457	12·81	16·50	5·43	55·11	6·24	3·91	—	65	30	5
464	14·04	16·41	5·09	55·44	5·38	3·64	—	—	—	—
481	14·78	17·00	5·81	52·70	5·50	4·21	—	45	55	—
484	14·04	14·59	4·27	57·91	5·51	3·68	—	65	25	10
Average ..	13·70	16·32	5·25	54·52	6·17	4·04	—	—	—	—
Average Grades 2, 3	13·39	15·40	4·90	55·86	6·50	3·95	—	—	—	—
				Grades 1, 2 and 3 mixed.—Straight run Offals.						
462	13·39	14·39	4·81	59·86	4·62	3·13	30	35	30	5
463	13·89	16·21	4·42	57·85	4·25	3·38	40	40	20	—
465	12·79	16·38	4·43	59·80	3·76	2·84	—	—	—	—
474	14·99	15·73	4·78	56·58	4·47	3·45	—	—	—	—
477	13·71	15·59	4·90	56·58	5·51	3·71	—	—	—	—
Average ..	13·75	15·66	4·67	58·13	4·52	3·30	—	—	—	—
Average Grades 1,2,3	13·17	15·52	4·41	58·50	4·95	3·45	—	—	—	—
				Grade 3 and Bran mixed.—Coarse Pollards.						
480	14·93	14·69	4·29	53·98	7·36	4·75	—	—	—	—

explained on the assumption that the germ is concentrated in the coarse middlings.

Further confirmation as to the composition of the various grades is afforded by Table II., which gives the percentage composition of a number of samples shown by Diagram I. to be mixed grades.

The figures for individual samples of mixed grades are, as might be expected, more variable, but in every case the average composition of all the samples of each mixed grade agrees very closely with the figures obtained by averaging the composition of the two or more pure grades of which the mixed grade in question is shown in Diagram I. to be composed. In Table III. an attempt has been made to work out figures to express the relative feeding values of the various pure and mixed grades.

TABLE III.—*Starch Equivalents and Food Units.*

Grade.	Digestible Nutrients.				Starch Equivalent.		Food Units per ton.
	Protein.	Fat.	Carbo-hydrates.	Fibre.	Main-tenance.	Produc-tion.	
Graded Offals.							
Fine middlings	13·2	3·0	52·0	1·8	74	72	91
Coarse middlings ..	13·8	4·3	45·5	5·0	74	64	92
Pollards	11·6	4·0	44·5	7·1	72	60	87
Bran	10·6	2·8	38·0	2·8	58	45	72
Mixed Offals.							
Straight run middlings ..	13·2	3·9	48·4	3·8	74	68	91
,, pollards ..	13·2	4·5	43·4	5·8	73	62	90
,, offals ..	12·8	4·0	47·0	4·4	73	66	89

The figures are admittedly far from satisfactory. Owing to the great variation in milling practice and to the haphazard method, or lack of method, of naming the different grades of offals, it is impossible to identify with certainty the grades on which digestibility determinations have been made. The digestible nutrients in Table III. have been calculated as follows: The percentage digestibility of the various constituents in flour and bran are known with considerable certainty. It has been assumed that the percentage digestibility of each constituent falls uniformly according to the size of the particles from flour to bran. This is probably true except in the case of the fibre of bran, which is very much less digestible than the fibre of pollards.

The starch equivalents for maintenance and for production, and the number of food units per ton, are calculated from the digestible nutrients by the ordinary methods.

The number of samples examined is not large enough to establish standard compositions for the various grades with any very great degree of accuracy. It is, however, sufficient to show several points very clearly :—

(1) Wheat offals are commonly separated into three grades—fine middlings, coarse middlings, and pollards.
(2) These grades are characterised not only by a limited range in the size of their particles, but by a definite chemical composition.
(3) In some mills it is customary to turn out offals consisting of mixtures of two of the above grades, and in some cases all the offals, except bran, are sold together.
(4) With the present indefinite grading and the great variation in local names, it is impossible to assign a standard composition and a definite feeding value to any kind of offal except bran. This must be a considerable handicap against the sale of offals.

Finally, it is suggested that millers should adopt a uniform system of grading and naming their offals. It would possibly perplex farmers if local trade names were dropped, and they could easily be retained in spite of standard grading if some such system as the following were generally adopted :—

The finest grade of offals, called above fine middlings, is sold in various districts under such names as seconds, fine thirds, biscuit middlings, and so on. It might still be sold under any one of these names with the addition of S.G.1. (standard grade 1) to signify that it is the finest grade of offals, and that it is separated between silk sieves Nos. 3 and 10.

The second grade, called above coarse middlings, might be sold under the usual trade names, such as sharps, thirds, parings, boxings, and so on, with the addition S.G.2. (standard grade 2) to indicate that it is separated between wire sieve 24 and silk sieve 3.

The third grade, called above pollards, might be sold as randans, coarse sharps, gurgeons, etc., with the addition S.G.3 (standard grade 3) to indicate that it is separated between wire sieves 16 and 24.

Millers who are accustomed to sell mixed offals might still do so under their usual local names, with such additions as S.G.1 and 2, S.G.2 and 3, S.G.1, 2 and 3.

If some such such system as this could be generally adopted it would be possible to collect and analyse large numbers of samples of each standard grade so as to assign to each grade a standard composition. It would also be worth while

making digestibility determinations of typical samples of each grade, when the feeding value of each grade could be fixed with greater certainty.

THE CULTIVATION OF MANGOLDS ON THE FLAT IN EAST SUFFOLK.*

DAVID BLACK.

AT the present time, when it is necessary to produce as much food as possible on the farm for the purpose of feeding stock, it is desirable to inquire if it is not possible to improve on the common practice of growing mangolds on the ridge. A great many farmers look on the mangold crop as a very expensive one to grow and one that often does not pay, but this is to a great extent the fault of the method of cultivation adopted. In many instances an attempt is made to grow too large an area of mangolds. The crop is often insufficiently manured and hence the weight of mangolds produced is small. On the other hand, if by more generous manuring the same quantity can be grown on a smaller acreage, a great saving in labour and other expenses is effected.

As an illustration, compare the case of a farmer who grows 10 tons per acre on 10 acres with that of another farmer who grows 20 tons per acre on 5 acres. They both produce 100 tons of mangolds, but the crop produced on the 5 acres will cost a great deal less to grow than that on 10 acres, for the following reasons: The 20-ton-per-acre farmer has only half the amount of land to plough, ridge, roll, drill, horse-hoe, hand-hoe, etc., compared with the 10-ton-per-acre farmer, and, besides this, he has only half the rent and rates to pay, as he is only using half the amount of land. With regard to manure, the 5-acre farmer may use double the quantity per acre and not exceed the quantity used by the 10-acre farmer. The advantage financially is, therefore, greatly in favour of the farmer who grows the same amount of mangolds on the smaller acreage, and at the same time a more economical use is made of the labour at his disposal. From a national point of view the gain is more important still, for twice the amount of food is produced per acre.

* This article is based on a paper read to the Stowmarket Farmers' Club in January last. Mr. Black, the author, has three times won the challenge cup offered by the Club for the heaviest crop of mangolds.—ED.

The difference between the two weights per acre is very moderate indeed, and can easily be increased with careful cultivation under favourable circumstances, but it serves to illustrate the fact that there are certain standing charges on the mangold crop, such as rent, rates, horse and hand labour, etc., which cannot be avoided, whether the crop be small or large, so that the heavier the crop of mangolds, the smaller the share of these standing charges each ton of mangolds has to bear, and *vice versâ.* This principle applies to all farm crops, but in the case of grain crops, a point is reached beyond which it is not safe to go as there is danger of a laid crop. There is no danger of this kind in the case of mangolds, and a great increase in the yield can be ensured with advantage to the grower.*

The System of Cultivation recommended to achieve this end is that of growing on the flat instead of on the ridge, as is the usual custom on heavy land in Suffolk. It may not be applicable to every class of soil, or perhaps to parts of the country where the rainfall is excessive, but there are few conditions under which it cannot be tried with advantage.

Mangolds usually follow a corn crop, but they may be grown successfully year after year on the same land, and in certain circumstances this practice is an advantage. Where a large quantity is grown for cattle it is a great convenience to grow part, at least, on a field near the homestead, Otherwise a great deal of heavy cartage during wet weather if required, and as this cannot always be done when the four-course rotation is rigidly adhered to, it is useful to grow the mangolds on a field near the farm buildings. Whether they are grown successively or after a corn crop, the system of culture recommended is practically the same.

A fairly clean piece of land should be selected for the crop. It is very difficult to grow a big crop of mangolds on land that is badly infested with couch or twitch. Other weeds do not matter so much as they can be disposed of in the cultivation of the crop. In some favourable seasons it is possible to do a great deal towards cleaning the stubble by autumn cultivation, and, whenever this is possible, it should be carried out thoroughly where necessary.

Manuring.—During autumn or winter the farmyard manure should be carted on to the land. The amount recommended

* It is, of course, well known that a point is eventually reached after which returns for extra labour and capital employed will diminish. This article suggests that, with mangolds, as commonly grown, this point has not nearly been reached.—Ed.

varies according to the supply at disposal, but, as mangolds can do with generous manuring, at least 20 loads per acre should be applied. This should be spread as soon as possible, as it is not advisable to leave it for any length of time in heaps on the land. It can then be ploughed in to a good depth and the land left exposed to the beneficial action of frost.

Towards the end of March or the beginning of April, a liberal supply of phosphatic and nitrogenous manures should be sown on the surface of the land. A dressing of 4 cwt. per acre of 30 per cent. superphosphate, or 6 cwt. per acre of basic slag, is recommended as suitable. With respect to nitrogenous manures, nitrate of soda or sulphate of ammonia is the best to apply to mangolds. In normal times, when it is easily obtainable at a reasonable price, nitrate of soda is to be preferred to sulphate of ammonia, but at present sulphate of ammonia is the better and cheaper nitrogenous manure to use. Two cwt. per acre should be sown before the land is stirred in spring, and it can either be mixed with the superphosphate before sowing or sown separately. If basic slag is used instead of superphosphate it must not be mixed with sulphate of ammonia, but should be sown separately, otherwise ammonia will be lost by chemical action. When nitrate of soda is used as the nitrogenous manure, 1 cwt. should be sown per acre as soon as the plants have made their appearance, and another cwt. after the plants have been singled.

Since the commencement of the War, potassic manures have become unobtainable; on some soils, especially those of a light nature, they give a good return when applied to the mangold crop. Four cwt. of kainit per acre, or 1 cwt. of sulphate of potash or muriate of potash per acre may be recommended, and should be sown before the soil is stirred in spring. On some soils common salt gives a considerable increase in the mangold crop, but it should be used with care on soils of a heavy nature as it is apt to make them work badly afterwards.

Cultivation and Sowing.—After the artificial manures have been sown, the land should be harrowed and stirred with a cultivator till a good level seed-bed is obtained. This treatment will also have the effect of thoroughly mixing the artificial manure with the soil.

The seed ought to be drilled, if possible, during the first half of April, as early drilling generally gives a better crop than late drilling. In drilling, care should be taken not to bury the seed too deeply as this may produce weak plants or perhaps

no plants at all. A liberal quantity of seed should be used, as the cost of a few extra pounds of seed is immaterial when compared with the importance of obtaining a good plant. An ordinary corn-drill, with some of the coulters taken out and with cups suitable for mangold seed, is the best machine for drilling mangolds on the flat.

The width between the rows is of considerable importance when a big crop of mangolds is desired. A distance of from 20 to 24 in. is suitable, and allows a horse to walk between the rows when horse-hoeing. Comparative trials have shown that a bigger crop can be obtained with even narrower rows, but the difficulty of horse-hoeing is slightly increased unless a horse that walks close in the rows is available. After the drilling is done, it is important to roll the land well if dry enough, as a firm seed-bed suits the mangold plant and makes subsequent operations easier.

After-Cultivation and Singling.—As soon as the plants are up and big enough to be seen in the rows, horse-hoeing should commence. It should be done as closely as possible to the plants, with side hoes, and repeated in a few days if the weather is fine. Weeds are easily killed if hoed in time, and the earlier horse-hoeing is done the less trouble the weeds will give afterwards.

The next operation is to "chop out" and "single" the plants to a regular distance of 12 in. apart. This should also be done early, when the plants are quite small.

It will be found that they grow better if singled early than if left till they are crowded by each other, and by weeds. The only other operations necessary before they are ready to pull in the autumn are horse-hoeing at intervals and one more hand-hoeing.

Storing.—When storing the mangolds in the autumn, a good deal of labour can be saved by making a big square heap of them, and by covering the top with a good coat of straw only, and the sides by a coat of straw and earth, instead of carrying out the old system of making a long, narrow "hale" or "clamp," which entails a great deal more labour in earthing up. The mangolds appear to keep as well in the big square heaps as they do under the old system.

Advantages of Growing on the Flat.—The advantages claimed for the system of growing mangolds on the flat instead of on the ridge are these :—

(1) Less labour is required to prepare the land for the crop, as only one ploughing is needed and there is no ridging and splitting of ridges required.

(2) The farmyard manure can be applied during the autumn and winter, so relieving the pressure of work in the spring.

(3) Merely stirring the surface of the land in the spring preserves the moisture and ensures a good plant of mangolds, whereas ploughing and splitting ridges in dry weather is very often the cause of failure to secure a plant, owing to loss of moisture.

(4) The crop can be put in earlier and, as a rule, an early-sown crop is the best.

(5) By having the rows closer together on the flat than is possible on the ridge a greater number of mangolds can be grown per acre. These may be smaller, but repeated analyses have shown that small roots contain relatively more feeding material than large specimens.

AN EXPERIENCE IN THE BREAKING UP AND CROPPING OF OLD PASTURE.

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A 30-acre field on the Wye College farm, for many years arable previous to being seeded down in the early nineties, was in part ploughed up in 1913 and in part in 1914. Throughout the 20 years as grass the pasture was very inferior. In parts the herbage was very thin, and elsewhere a large proportion of weeds and inferior grasses was to be found. Manurial treatment had after 10 years effected some improvement, but the prospects of a good pasture were remote. The field is on the outskirts of the Brick Earth formation in the valley of the Stour. The soil of this formation is of a fertile nature, easily worked when not too wet, retentive of moisture, and suitable for the successful cultivation of cereals, roots, potatoes, etc.

The ultimate cropping proposed for this field is the following five-year rotation: Winter oats, potatoes, wheat, clover and grass ley for two years. In September, 1913, Plots I., II. and III. of the field were steam-ploughed to a depth of 8 in. The remainder—Plots IV. and V.—was steam-ploughed to a similar depth in July, 1914. A summary of the cropping and manuring of each of the five plots is given in the following table:—

Cropping and Manuring of Five Plots, 1913-17.

1913.	*1914.*	*1915.*	*1916.*	*1917.*
PLOT I.—Pasture, grazed. Steam-ploughed in September.	Potatoes (5 cwt. bone and meat meal, 1 cwt. sulphate of potash, and 1 cwt. sulphate of ammonia per acre).	Wheat	Ley (5 cwt. 26 per cent. basic slag per acre).	Ley.
PLOT II.—Pasture, grazed. Steam-ploughed in September.	Wheat	Potatoes (5 cwt. bone and meat meal, and 1 cwt. sulphate of ammonia).	Wheat (1 cwt. sulphate of ammonia in January).	Ley (6 cwt. 22 per cent. basic slag in December, 1916).
PLOT III.—Pasture, grazed. Steam-ploughed in September.	Winter Oats ..	Winter Oats (3 cwt. superphosphate, 1 cwt. muriate of potash, and 1 cwt. nitrate of soda).	Potatoes (5 cwt. basic slag, 1 cwt. sulphate of potash, and 1 cwt. sulphate of ammonia).	Wheat.
PLOT IV.—Old pasture, grazed.	Mown for hay. Steam-ploughed in July.	Winter Oats ..	Winter Wheat (1 cwt. sulphate of potash and 1 cwt. sulphate of ammonia).	For Potatoes.
PLOT V.—Old pasture, grazed.	Mown for hay. Steam-ploughed in July.	Winter Oats ..	Peas (5 cwt. basic slag, 1 cwt. sulphate of potash and 1 cwt. sulphate of ammonia).	Winter Oats.

Particulars of Crops.—PLOT I.—1914—*Potatoes* —The land was cross-ploughed in January and worked to an excellent tilth in April when the potatoes were planted. A 6-ton crop of King George V. and British Queen was harvested in August. The potatoes were attacked by wireworm, but no difficulty was experienced in disposing of the crop at a fair price.

1915—*Wheat.*—The land was ploughed in September, 1914, to a depth of 8 in., and wheat was drilled at the end of September. The wheat germinated well. An attack by wireworm immediately occurred and continued for two months. A wet winter combined with this attack resulted in a very poor plant on a considerable area of this plot. The headlands, however, carried an excellent crop and suggested shallower cultivation for wheat after potatoes. The crop yielded 29 bush. per acre.

1916—*Seeds.*—The following mixture of grasses and clovers was sown in the wheat crop in April :—

3 lb. Timothy ..	.. per acre.	5 lb. Alsike .. .. per acre.
8 ,, Perennial rye-grass	,,	4 ,, White clover (Dutch) ,,
5 ,, Giant hybrid clover	,,	3 ,, Trefoil .. .. ,,

A good plant was obtained. This was grazed in the autumn of 1915, and received basic slag in November. It was not further grazed, and produced a very heavy crop which was much lodged by early June. The first crop of hay was estimated to be over 3½ tons per acre. The timothy formed a very small proportion of the grasses. Alsike and trefoil were very plentiful. A first-class second growth followed and was

partly used as green fodder, while the remainder was folded over the land by cake-fed sheep.

PLOT II.—1914—*Wheat.*—For this crop the land was three times harrowed and the wheat drilled in early October. A very good plant was obtained. This was steadily reduced by wireworm through the winter and early spring months until parts of the field carried a very thin plant. The attack was worst on the side of the plot adjoining the Plot III. oats, which were apparently entirely free from attack. The wheat crop thrashed 26 bush. per acre.

1915—*Potatoes.*—The land was ploughed in winter and planted with British Queen and King George V. potatoes. Early summer frosts ruined a promising crop. The result was 4¼ tons per acre. Wireworm attacked this crop no less than Plot I. the previous year.

1916—*Wheat.*—After the potatoes were cleared the land was ploughed to a depth of 2½ in., and wheat was sown early in October. An excellent plant was obtained and this stood well. No wireworm attacked the crop, which looked well throughout, and yielded over 48 bush. per acre in a season of poor yields locally. The freedom from wireworm attack was attributed in part to the shallow ploughing.

The field was sown in April with a seeds mixture similar to that sown on Plot I. in 1915, and is a good plant.

PLOT III.—1914—*Winter Oats.*—These were sown under the same conditions as the wheat on Plot II. The crop looked well throughout and yielded 104 bush. per acre. This crop was not attacked by wireworm, though it adjoined the wheat on Plot II. which was severely attacked, particularly on the side adjacent to the oats.

1915—*Winter Oats.*—The land was steam-ploughed, manured and harrowed, and the seed was drilled in October. The land was particularly dry and in a very open condition. The crop was severely attacked by wireworm well into the spring. A very thin crop resulted and yielded 38 bush. per acre.

1916—*Potatoes.*—The land was ploughed in late autumn A very wet spring caused planting to be delayed until late in May. A crop of about 5½ tons per acre was raised in September—variety, King George V. The tubers were but slightly attacked by wireworm.

1917—*Wheat.*—After the potatoes were cleared the land was broad-shared to a depth of 2½ in. in early October last, and wheat sown. To the end of January the plant had not suffered from wireworm.

PLOTS IV. and V.—1915—*Winter Oats.*—The observations on the cultivation of Plot III., 1915, apply to these plots. The plant was in parts good while other parts were practically bare. A yield of 51 bush. per acre was obtained.

PLOT IV.—1916—*Wheat.*—The land was steam-ploughed in October, harrowed, broad-shared about 2½ in. deep with the Kent plough, and the seed was drilled late in the month. The crop looked promising throughout and yielded 49½ bush. per acre.

PLOT V.—1916—*Peas.*—Early Minter Grey Peas were drilled towards the end of January. March proved a very unfavourable month for the peas and a thin plant resulted. This grew out well and yielded 30½ bush. per acre.

1917—*Winter Oats.*—The plot was steam-ploughed in September last, harrowed and broad-shared in October and the seed drilled. At the end of January there was every prospect of a good crop.

The conclusions to be drawn from an experience extending over three years are that the risks of damage by wireworm run by arable land crops on recently broken up pasture may be much reduced by suitable cultivations. In each instance where a very firm seed-bed has been obtained for corn a satisfactory crop has resulted. Wheat on Plot I. in 1915, and on Plot II. in 1914, and oats on Plots III., IV. and V. in 1915, were the crops where the seed-bed was in the least consolidated condition, and these crops suffered severely. Plots II. and III. in 1914 indicate oats rather than wheat as the safer first crop after pasture.

THE ENCOURAGEMENT AND IMPROVEMENT OF LIGHT HORSE-BREEDING, 1915-16.*

THE outstanding feature of the Horse Breeding operations of the Board for the year under review (1st November, 1915, to 31st October, 1916) was the acquisition of Colonel Hall Walker's well-known breeding stud at Tully, in Ireland, and his training establishment at Russley, in Wiltshire. The stud farm and premises were purchased by the Government, but the valuable stud of high-class horses and mares, together with a large

* This article replaces the Annual Report on the Administration of the Funds provided for the Encouragement and Improvement of the Light Horse-breeding Industry for 1915–16, which will not be issued separately.

head of cattle, provender, stores, farm furniture, etc., were very generously presented to the Government by Colonel Hall Walker so that the stud could be taken over, as it was on 1st January, 1916, as a well-equipped going concern. At Lord Selborne's invitation Captain H. Greer was good enough to undertake, for the period of the War, the honorary directorship of the National Stud, as it is now called, and the Board are greatly indebted to him for the valuable services he is rendering.

The number of horses which were made over to the Nation as a gift was 3 stallions, 52 mares, 19 yearlings and 9 horses in training (3 of which will be returned after their racing career), and, as they included such well-known stallions as "White Eagle," "Royal Realm" and "Great Sport," and mares such as "Flaming Vixen," "Burnt Almond" and "Countess Zia," the value of Colonel Hall Walker's gift will be realised.

The National Stud was established for Military considerations, as have been all the State studs on the Continent. It is intended that the National Stud shall be carried on as an establishment for breeding high-class thoroughbreds, as they are the foundation stock of the breed of light horses, the reservoir from which the small trickle of Army remounts flows annually in times of peace, but which can be drawn upon to a very large extent in time of emergency, as happened on mobilisation in 1914.

The essential qualifications for cavalry horses and hunters are constitution, courage, and stamina, and for the transmission of these hidden, but all-important, characteristics we must look to the thoroughbred horse that has proved a success or at any rate a trier on the racecourse. The unseen qualifications of heart, brain and nerve constitute the value of the thoroughbred in the general scheme of horse breeding, and the possession of them can be determined in one way and one way only, *i.e.*, on the racecourse.

Thoroughbred horses have to pass the above-mentioned test before they can be regarded as suitable sires; but it does not follow that State ownership of a blood-stock breeding establishment imposes any necessity on the State to race the horses bred by them, or renders them any more directly associated with racing than they are at present in awarding premiums annually to stallions whose soundness, stamina and constitution have been proved by their ability to stand the test of training and racing.

The Board do not intend to race the horses bred by the National Stud. They propose to follow the practice of many private breeders of blood stock, and sell as yearlings the majority of the horses bred, retaining only the very few of them which will be leased for their racing career and subsequently returned to the Stud.

In this connection it may be of interest to record that during the year under review two lots of yearlings have been sold from the National Stud at the Newmarket sales. The first lot of six averaged £505, and the second lot of ten averaged £596, prices which may be considered as satisfactory in these abnormal times. Seven two-year-olds have been leased for training and racing and will be returned to the Stud in due course.

In spite of the many difficulties under which the breeding of blood stock is being carried on during the War, it is hoped that the National Stud will not be a serious charge, if it is a charge at all, on the Public Exchequer during its first year of existence, but, as the balance-sheet cannot be completed for two months after the period covered by this Report, it is not possible to make any definite statement at present as to the financial aspect of the enterprise.

So far as the training establishment at Russley is concerned, it is intended to use it as a Government stallion depot when purchases of stallions are made by the Board to supplement those provided by private owners under the existing scheme. For the present, however, it is being utilised by the War Office as a remount depot.

Apart from the establishment of the National Stud, the horse-breeding operations of the Board for the year under review do not call for comment in any special direction. Reference, however, must be made to the increasing difficulties experienced by breeders in carrying on their establishments. The depletion of their staffs, owing to the needs of the Army, the increased cost of feeding stuffs, the curtailment of hunting, and the absence of the foreign buyer, are factors which adversely affect the Light Horse Breeding industry at the present time. Fortunately, during the past year the Army were buyers of all classes of horses that were suitable for their purposes, and though the prices paid were not very remunerative they enabled breeders to dispose of stock for which otherwise they would probably not have found a market.

In another direction, also, the Army came to the rescue of breeders, and from their remount depots supplied for the

Service Season, 1916, a number of men for employment as stallion leaders, of whom there was a shortage. The assistance of the Remount Department was very opportune and was much appreciated, as it enabled many stallions to be travelled, which otherwise would have remained at home or perhaps have been castrated.

When account is taken of the abnormal conditions that prevailed, and the apprehension that existed as to the future, it was not surprising that the number of mares sent to the premium stallions was fewer in 1916 than in the preceding three years. It averaged, however, 69 mares per stallion for 100 stallions, and this number cannot be considered altogether unsatisfactory.

In this connection it may be of interest to show in tabular form the number of Premiums awarded, and the results of the Service Seasons during the last seven years:—

Year.	King's Premiums.			Board's Premiums.		
	No.	Mares Served.	Mares Served per Stallion.	No.	Mares Served.	Mares Served per Stallion.
1910*	28	1,540	55	—	—	—
1911	50	3,245	65	10	552	55
1912	50	3,438	69	25	1,655	66
1913	44	3,280	75	25	1,581	63
1914	50	3,820	76	28	1,756	63
1915	50	4,317	86	40	3,067	77
1916	60	4,360	73	40	2,542	64

*The figures for 1910 relate to the last year of awards by the Royal Commission on Horse Breeding.

For the years 1910, 1911, and 1912 the figures refer to Great Britain, but in subsequent years the number of stallions does not include those which travelled in Scotland, It will be seen at a glance, therefore, that the number of sires subsidised has increased annually, and, as it is generally admitted that they have also shown progressive improvement in quality, it is not unreasonable to think that the Premium System must be tending to improve and grade up the quality of many of the light horses bred in the country.

Another part of the Board's scheme, from which improvement in horsebreeding may be expected to result, is the voluntary registration of stallions. Judging by representations received it appears that breeders are now in favour of the adoption of

legislation to require compulsory registration for horses that travel, and those concerned may like, therefore, to examine returns which show what has been accomplished by the voluntary system.

The Registration Scheme was initiated in 1911, when 313 stallions were registered.

In	1912	there	were	715	stallions	registered.
,,	1913	,,	,,	837	,,	,,
,,	1914	,,	,,	1,220	,,	,,
,,	1915	,,	,,	1,471	,,	,,
,,	1916	,,	,,	1,654	,,	,,

The annual increase is a tribute to the commercial value of the Board's certificate, and in view of the large number of stallions registered in 1916 it is not surprising that owners of certified stallions should hold the view that they should be protected from the competition of unsound horses whose chief attraction is often a low service fee.

Foaling Results of Service Season, 1915.—The difficulty, to which reference has been made in previous reports, of obtaining prompt and accurate foaling returns still continues, but not to so great an extent as it did in previous years. Many mare owners apparently fail to realise that it is to their interest that these returns should be accurate, so that stallions, which are proved to be really shy getters, can be refused entry for the Premium Shows. In fairness, too, to stallion owners, who are now paid largely on results, every care should be taken to furnish a return in respect of every mare in foal, and it is hoped that mare owners will bear in mind their responsibility in this matter.

The foaling results to the services in 1915 cannot be regarded as altogether satisfactory. On the returns received 54 per cent. of the mares served by the King's Premium stallions proved in foal as compared with 58 per cent. in the previous year. Two stallions got only 28 per cent. of the mares served by them in foal. On the other hand, Mr. Kelway-Bamber's stallion "Rockaway" served 90 mares and had a foal-getting percentage of 75—the highest of any King's Premium stallion for the year under review.

The foal-getting records of the Board's Premium stallions were for the first time slightly higher than those of the King's Premium stallions, their average foal-getting percentage being 55, which is an improvement on the percentage of 53 of the previous year. The best getter proved to be Messrs. T. & W. Walton's stallion "Lord of the Valley" who served 90

mares and got 81 per cent. of them in foal. The least satisfactory sire was one that served 62 mares and had a foal-getting percentage of only 20.

With the completion of the foal returns it is possible to give the average payments made by the Board and the estimated average earnings of the stallions to which Premiums were awarded in 1915.

The average amount paid by the Board was £323 in respect of a King's Premium and the maximum £372, which, with the service fee of £1 payable by mare owners, makes the maximum earnings £462 and the average £409. An additional £100 was paid in respect of the Super Premium horses.

The comparative figures for the Board's Premium stallions are—average payment by the Board £166, maximum £213; average earnings £243 with a maximum of £303.

Service Season, 1916.—The annual show of Thoroughbred Stallions was held on 29th February and 1st March at the Agricultural Hall, Islington. The entries were 174 in number, a considerable increase on the previous record of 131.

The judges were Sir Gilbert Greenall, Bart., C.V.O., the Earl of Orkney and the late Mr. R. G. Carden. They reported that the high standard of merit shown by the Premium stallions in 1915 was fully maintained, and that for the first time on record the horses shown in every class were of sufficient merit to justify awards without bringing in any reserve horses from the stronger classes as had always been found necessary in previous years.

Sixty King's Premiums (including twelve Super Premiums) were awarded as compared with 50 in 1915. For the third year in succession the King's Cup was won by "Birk Gill," the property of Captain T. L. Wickham Boynton and Mr. H. A. Cholmondeley—the reserve horse being "Gilgandra," whose owners, the Compton Stud, won a similar success in the two previous years.

The number of mares served by the 60 stallions, to which Super and King's Premiums were awarded, was 4,360, being an average of 73 mares a stallion.

In addition to the 60 stallions to which King's Premiums were awarded 40 other stallions travelled to which Board's Premiums had been awarded. The mares served by the latter stallions numbered 2,542, an average of 64 mares a stallion.

Of the horses to which Board's Premiums were awarded 35 were thoroughbreds and the remainder were hunter sires. Twenty-six of the former had been exhibited at the London

Show, and 11 had obtained Reserve Cards, which are only awarded to stallions up to King's Premium merit.

As in previous years the service arrangements were supervised by voluntary local committees, to the members of which the Board are much indebted for assistance.

Riding Pony Premiums.—The award of these Premiums, which are of the approximate value of £80, was first made in 1914 on the recommendation of the National Pony Society, with the object of encouraging the use of high-class pony sires for the service of pony mares not exceeding 14.2 hands. Six Premiums are offered annually, but apparently they are not sufficiently attractive in value to secure a large entry of pony stallions to compete for them.

The average number of mares served in 1915 and 1916 was 53, and the foaling percentage to the 1915 service averaged 55.

Arrangements were made to travel three of the ponies, to which Premiums were awarded in 1916, in the vicinity of mountain or moorland districts (New Forest, Dartmoor and Church Stretton) so as to be available for the service of "Borderland" mares. It is possibly in this direction that benefit to the pony-breeding industry can best be secured, provided—and this is very important—the pony stallions are suitable in type and conformation for the mares of the districts in which they are located.

Premiums to Welsh Cob, Fell, Mountain and Moorland Ponies.—Premiums for Welsh Cob Stallions are approximately £50 in value. They are awarded on the recommendation of county committees, but *only in respect of stallions which are certified* by the Welsh Pony and Cob Society to be of the Old Welsh type. Free nominations are authorised for issue to 25 mares for service by each stallion on condition that the mares are entered or accepted for entry in the Welsh Stud Book, and have been passed sound for breeding purposes. Premiums were awarded to 12 cob stallions in 1916. Three of them travelled in Cardigan, two in each of the counties of Brecon, Carmarthen, Montgomery and Radnor, and one in Merioneth.

Premiums for Fell Pony Stallions average £45 in value, and are awarded by judges selected by the Fell Pony Committee. Five such Premiums were allotted in 1916 and the competition for these awards is very keen. It is worthy of note that Fell ponies won the prize of £10 offered by the National Pony Society for the best group of mountain and moorland ponies exhibited at their Show in March, 1916, at the Agricultural Hall. The stallion in this group, "Glengarry"—a Premium

pony—also won the Special Challenge Trophy offered by the proprietors of "Country Life" for the best pony in the Group Class.

The efforts that are being made by the Board to improve the breeds of mountain and moorland ponies are being well supported by the various local pony associations. Premiums of £5 are awarded to stallions which have been registered by the Board and selected as of sufficient merit by a judge—Mr. Coltman Rogers, in Wales, and Mr. T. F. Dale, in the New Forest. Assistance is only given in districts in which regulations under the Commons Act, 1908, have been put into operation, or where arrangements are made to secure observance of similar regulations, as in the New Forest, which prohibit the turning out on commons, etc., of any immature or unsuitable pony stallion. Twelve *Premiums were awarded in the Eppynt Hills district* (Brecon), 10 in the New Forest, 8 in Church Stretton (Salop), 5 in the Black Mountain (Carmarthen) and 3 in Penybont (Radnor).

Brood Mare Scheme.—No funds were available during 1916 for the award of grants to county committees for the purchase of brood mares, and the scheme may be considered to be temporarily suspended.

Registration of Stallions.—The number of stallions registered for the year under review was 1,654. Of these 902 were Shires, 263 Thoroughbreds, 155 Ponies, 123 Hackneys, 116 Clydesdales, 68 Suffolk Punches, 16 Hunters, 8 Yorkshire Coach Horses, 2 Cleveland Bays, 1 American Trotter.

The number of stallions rejected was 125, of which 77 were Shires, 22 Thoroughbreds, 14 Clydesdales, 5 Hackneys, 4 Suffolk Punches and the remaining 3 were a Pony, a Yorkshire Coach Horse, and a Cleveland Bay. Sixty of the rejections were in respect of stallions which had not been previously examined for registration, and the other 65 were stallions which had been registered in the previous year.

The ages of the stallions rejected for registration included all ages from three to sixteen, excluding eleven and thirteen, but even those two years were included in the ages of the stallions rejected on examination for re-registration. These returns afford evidence of the difficulty of fixing an age limit after which a sound stallion should be given a life certificate—a suggestion which has been frequently made to the Board.

The diseases, on account of which the above-mentioned 125 stallions were rejected, were: whistling (34), roaring (30), sidebone (28), cataract (9), ringbone (6), defective genital

organs (6), stringhalt (5), bone spavin (3), shivering (2), navicular disease (1), and one stallion was rejected on account of bad conformation. There were only ten appeals against the verdict of the examining veterinary surgeons, and of this small number only four were successful.

ORDINARY WHITE CLOVER SEED *VERSUS* WILD WHITE CLOVER SEED.

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THE great value of wild white clover seed in the formation of pastures seems to have been definitely established,* but its superiority over ordinary white or Dutch clover seed for this purpose is usually referred to in general terms.

No numerical data appear to have been published showing the real difference that exists even in the early stages in the formation of a pasture, where equal quantities of the two kinds of seed have been used.

Experiments were started in 1914 by the Department of Agriculture of the University College of North Wales, on the laying down of land to permanent pasture, and in these experiments the seeds-mixtures were made up as shown in Table I. There were five plots, each ¼ acre in extent, at each of a number of centres throughout the four North Wales counties in the College area. Similar plots were again laid down in 1915 at other centres.

The seeds-mixture for Plot A included 2 lb. per acre of wild white clover seed, the seeds-mixtures for Plots B, C and D, included 2 lb. per acre of ordinary white Dutch clover seed, while that for Plot E included 1 lb. per acre of ordinary white clover seed

Unfortunately, perhaps, from the point of view here taken, too many points were under investigation, and the fact that all the seeds-mixtures employed varied considerably, apart from the variety of white clover used, might possibly be held to obscure, if not to vitiate, the effects of the varieties of clover.

* It seems to be necessary only to refer here to Professor Gilchrist's work and published papers, especially those on "Trials of Wild White Clover," published in this *Journal*: Vol. XVI., December, 1909, p. 705, and Vol. XXII., February, 1916, p. 1063.

TABLE I.—*Showing the Composition of the Seeds-Mixtures Sown on each Plot in lb. per acre.*

—	Lb. per acre.				
	Plot A.	Plot B.	Plot C.	Plot D.	Plot E.
Italian rye-grass	—	4	—	4	4
Perennial ,,	6	6	4¼	—	28
Cocksfoot	—	4	1½	6	2
Meadow foxtail	6	—	2¾	—	—
Meadow fescue	6	—	3½	5	—
Timothy	4	2	1¾	—	2
Tall fescue	6	—	—	4	—
Tall oat grass	—	3	—	3	—
Golden oat grass	—	—	—	½	—
Hard fescue	2	—	1½	2	—
Crested dogstail	—	1	1	—	½
Rough-stalked meadow-grass	—	1	¾	½	—
Smooth-stalked ,,	—	1	¾	2	—
Yarrow	—	¼	—	1	—
Burnet	—	—	—	8	—
Chicory	—	1	—	2	—
Kidney vetch	—	—	—	2½	—
Sheep's parsley	—	—	—	1	—
Broad red clover	4	2	—	—	4
Late-flowering red clover	—	2	1¾	2	2
Alsike	1	1	1½	2	—
Ordinary white clover	—	2	2	2	1
Wild ,,	2	—	—	—	—
Yellow suckling clover	2	—	—	—	—
Trefoil	—	—	—	—	1
Total	39	30¼	23	47½	44½

At each centre, however, ordinary white clover seed was used on four plots out of the five, and on three of these it was used in quantities per acre equal to the amount of wild white clover seed used on the other plot. Since Plots B, C and D also varied from each other in points other than white clover seed, it would appear that if they agreed fairly closely in the results shown by the white clover, the results for Plot A (wild white clover) would be fairly comparable with them.

Some irregularity is also introduced by the fact that the number of seeds per lb. differs in the two varieties. In samples tested by the writer, the average weight per 1,000 seeds of wild white clover was found to be 0·642 gramme, while 1,000 seeds of ordinary white clover averaged 0·747 gramme. In practice this is generally disregarded, and in the present case, where other factors also differ very considerably, it may perhaps, be neglected. It should be kept in mind, however, in order that corrections may be made in the results if necessary. Where equal weights of the two varieties are used, the

number of seeds of wild white clover is greater by about 17 per cent. than that of the ordinary white clover.

Another factor which must be considered is the presence of indigenous white clover, *i.e.*, white clover plants which do not owe their presence on the plots to the sowing of white clover seed. At each centre other plots were also laid out at the same time, on which the seeds of a particular grass were sown alone. It was found that the "indigenous" white clover sometimes developed unevenly on these latter plots, usually with a greater development on the rough-stalked meadow grass plot than on the others. This selective development, however, probably does not occur to any appreciable extent where a considerable mixture of grass and other seeds is used, so that in the experiments here under consideration, where fairly "full" seeds-mixtures have been used, and where the plots have been subjected to the same treatment throughout at each centre, this factor may be fairly considered negligible.

I.—**Results at Eighteen Months (12 Centres).**—Eighteen months after the plots had been sown down, the development of white clover in practically all cases was relatively small. Other clovers were present in most cases in considerable abundance. These two facts made it impracticable to examine the plots by the method described below. The results for this period must, therefore, be based on careful observation.

In all cases except one, the seeds-mixtures were sown down with a corn crop, and the herbage was mown for hay in the following year in all but two cases. The after-treatment varied considerably at the various centres, and the following summary gives the most important details :—

(*a*) A very marked difference of white clover in favour of Plot A was found at the centre where the seeds had been sown with rape, a dressing of 10 cwt. per acre of basic slag having been applied at the time of sowing. The field had been grazed in the first year.

(*b*) Where the seeds had been sown with corn, and no hay taken in the first year, a very slight difference in favour of Plot D apparently existed.

(*c*) Where two crops of hay had been taken in the first year, without any manuring of the young "seeds," there was no apparent difference in development of white clover at one centre, but a distinct difference in favour of Plot A at the other.

TABLE II.—*Showing Treatment of Plots at the Different Centres.*

—	*Caerdegog.* — *Good Medium Loam.*	*Trefri.* — *Sandy Loam.*	*Manor Farm.* — *Heavy Loam.*	*Saithaelwyd.* — *Medium Loam.*	*Pentre Mawr.* — *Variable (Loam).*	*College Farm.* — *Gravelly Loam.*
1913 ..	Farmyard manure, 3 cwt. superphosphate.* Roots.	Farmyard manure, 2 cwt. superphosphate, 2 cwt. kainit. Roots.	Special manure. Oats. Grass seeds (a complete failure).	Oats.	Swedes.	Farmyard manure. Full dressing of artificial manures. Mangolds.
1914 ..	No manure. Oats. Grass seeds.	No manure. Corn. Grass seeds.	10 cwt. basic slag. Rape. Grass seeds.	Oats. Grass seeds.	No manure. Corn. Grass seeds.	No manure. Corn. Grass Seeds.
1915 ..	No manure. Hay (two crops).	Farmyard manure. Hay.†	No manure. Grazed.	Farmyard manure. Hay.	No manure. Hay (two crops).	10 cwt. ground lime. Hay.
1916 ..	Farmyard manure. Hay.	4 cwt. basic slag. Hay.	Farmyard manure. Hay.	No manure. Hay.	No manure. Grazed.	5 cwt. basic slag, 1 cwt. sulphate of ammonia. Hay.

* Weights of artificial manures are per acre in each case. † One crop of hay in each case unless otherwise stated.

(*d*) Where farmyard manure had been applied to the young "seeds" and a single crop of hay taken in the first year, the difference was distinctly in favour of Plot A (wild white clover).

(*e*) At centres where no manure had been applied since the field was under roots, and a single crop of hay taken in the first year, the development of white clover was weak on all plots, but a difference in favour of Plot A was more or less marked in all cases.

It may be mentioned here that no constant difference was noticeable between Plots B, C and D (2 lb. ordinary white clover) on the one hand, and Plot E (1 lb. ordinary white clover) on the other hand, in respect of white clover development at 18 months.

II.—**Results at Thirty Months (Eight Centres).**—When the first of these centres (Madryn Mill, Bodfean, Carnarvonshire) was visited, it was noticed that the development of white clover on Plot A was very markedly greater than on the other plots. It was, unfortunately, not found possible to make a reliable numerical estimate of the amount of white clover on each plot, but results based on observation only can be stated as follows :—

Plot A—Fair development of white clover.

Plot B—Hardly a trace of white clover.

Plots C, D and E—Traces only of white clover.

At the remaining six centres the method described by Armstrong* was used for determining the approximate area covered by white clover on each plot.

Since it would be expected that the development of white clover would depend to a certain extent on the treatment of the land, as regards cropping and manuring, the particulars are given in Table II. in as much detail as possible.

Table III. shows the results obtained by the Armstrong method. All the fields were being grazed when the estimation was made. The figures for Trefri were obtained in August, while those for all the other centres, except the College Farm, were obtained in October.

The plots at the College Farm were also examined in October, but at that time the development of white clover was so weak on all the plots that no comparable figures could be obtained. By December the plant seemed to have recovered somewhat, and the figures given in the table were obtained in that month. The main cause of the weak development of white clover on these plots would seem to be the very

* S. F. Armstrong : *Journal of Agricultural Science*, Vol. II., 1907–8, p. 286.

heavy crop of hay obtained, following a dressing of basic slag and sulphate of ammonia* (Table II.).

Ten readings were made on each plot at each of the six centres†. Precautions were taken that the readings were made sufficiently far away from the margins of the plots to prevent possible contamination, but otherwise they were made at random, so that the personal factor should be completely eliminated. All the readings were made by the writer personally, so that the figures, although they may not represent the exact proportion of the area covered in each case by white clover, are quite comparable.

Since it was not intended in this paper to discuss fully the effect of different weights per acre of the same variety of seed, it is sufficient to state that while under the conditions of these experiments the results are irregular, the ratios of weights and areas covered show us distinct relationship (2 lb. : 1 lb. and 2·2 per cent. : 1·74 per cent. excluding Trefri throughout).

TABLE III.—*Showing Percentage of Area Covered by White Clover at Thirty Months.*

——	Plot A.	Plot B.	Plot C.	Plot D.	Plot E.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Caerdegog	10·6	0·6	1·1	0·6	0·4
Trefri	19·4	2·5	1·5	1·4	?
Manor Farm ..	36·5	3·3	2·7	2·0	3·5
Saithaelwyd ..	11·3	0·4	0·7	1·0	0·4
Pentre Mawr ..	36·4	4·4	5·7	6·3	2·9
College Farm ..	3·9	1·1	1·2	1·9	1·5
Averages..	19·7	2·05	2·15	2·2	1·74
			2·13 (B, C and D)		

Little comment is necessary on the results shown in Table III.

In each case the difference in favour of the wild white clover seed is quite marked, in spite of variation in soil and general treatment.

The results for Plots B, C and D differ but slightly from each other, so that it seems fair to assume that the variation in the other components of the seeds-mixtures has had no appreciable effect on the white clover results after 30 months.

* *Cf.* R. G. Stapledon: "The Response of Individual Species under Manures," *Journal of Agricultural Science*, Vol. VI., Pt. iv., December, 1914, p. 505.

† Except Trefri, Plot E.

If the average for Plots B, C and D be compared with the figures for Plot A, there is an increase of approximately 825 per cent. in white clover area due to the use of wild white clover seed. In view of this, the initial advantage of 17 per cent. in favour of the wild white clover, owing to the smaller size of the seed, becomes quite insignificant.

For practical purposes, however, this superiority of wild white clover seed over ordinary white clover seed is better expressed by stating that, taking the average for six centres at 30 months after sowing, nine times more ground was covered by white clover where the wild white clover seed was sown than where an equal weight of ordinary white clover seed was sown.

Summary.—(1) In most cases the superiority of wild white clover seed over ordinary white clover seed was more or less obvious at about 18 months after sowing.

(2) In some cases, its superiority did not become apparent until later.

(3) In *all* cases examined this superiority became obvious at about 30 months after sowing, unless for some reason the development had been checked.

(4) Numerical data show this superiority under various conditions quite unmistakably.

THE MANAGEMENT OF LIQUID AND SOLID MANURE IN BELGIUM.*

H. VENDELMANS.

CONSIDERABLE losses of fertilising matter, especially of nitrogen and potash, occur on the farm through the waste of liquid manure. This is not altogether the result of carelessness. In some parts of the country even model farms may be seen equipped with special means for carrying off the liquid manure into a ditch—a plan certainly not to be imitated. The farmer who wastes his liquid manure will find his profits considerably reduced. When it is wasted the soil of the farm is considerably impoverished, and in order to keep up his crop yields the farmer has to make good the loss so incurred by the purchase of artificials.

The waste of potash, which cannot well be replaced at present, is very great, and, with the exception, perhaps, of the

* Attention is specially directed to the fact that this article deals with conditions in Belgium.—*Ed.*

better management of the manure heap, the most important point to impress on the farmer, with a view towards increasing the supply of home-grown food, seems to be the careful collection of liquid manure. To this end liquid manure tanks ought to be regarded as an indispensable part of the equipment of every farm. There is no excuse for not having them, and where they do not exist they ought to be installed immediately.

Figures may help to make clear the advantage of installing a liquid manure tank. The quantity and quality of liquid manure produced per cow and per day vary considerably according to conditions, of which the most important is the nature of the food. The quantity may range from about 18 to 85 lb. As the result of numerous weighings the average for a cow weighing half a ton may be placed at about 33 lb. of urine per day, say about 5½ tons a year. (It should be remembered that urine differs from ordinary liquid manure). The average content of urine is about

Nitrogen	0·85 per cent.	Potash	1.40 per cent.
Phosphoric acid ..	0·01 ,,	Lime and Magnesia	0·13 ,,

which, for a year's production, gives

102 lb. of nitrogen.	169 lb. of potash.
2½ ,, phosphoric acid as tribasic phosphates.	16 ,, lime and magnesia.

Translated into more tangible figures this means about

6 cwt. nitrate of soda at 15½ per cent. nitrogen.
8 lb. superphosphate at 30 per cent. soluble phosphate.
12 cwt. kainit.

and about

20 lb. ground lime.

The value of the liquid manure will be seen at a glance from these figures; hence the reason for its conservation. On most intensively cultivated farms where a variety of crops is grown and the quantity of grass-land is reduced to the smallest extent sufficient for hay, the cattle pass practically the whole, or at least four-fifths of the year, in the shed; on other farms only about half of the year; so that the quantity of liquid produced in the shed varies accordingly. In every case, however, great losses will be prevented by the construction of tanks, and the cost of installation will be repaid in a few years' time.

Management in Belgium.

In Flanders the management of liquid manure has been thoroughly understood for many years. By means of tank vessels on the canals and carts on the roads liquid manure was formerly brought from the north of France to Belgian Flanders,

and in recent times trains of tanks might have been seen on the highways, a train being composed of from three to five tank-carts coupled together, and drawn by horses or oxen. No doubt Flanders and some of the other Belgian provinces partly owe their state of highly intensive cultivation to liquid manure.

Liquid manure tanks are constructed in various ways: oblong, square and round; many deep, a few shallow; some sunk, some level with the soil, and others above the soil; some covered with a roof of wood or earth, others with the top exposed to the air; some are situated close to the shed, some in the middle of the farmyard, some even out in the fields. Different means are employed to fill the tanks. A liquid manure cart or even a bucket may be used; the liquid may be drained into the tank by means of a sloping floor leading from the manure heap, or channels or pipes may be used. Again, there are different methods of emptying the tank. Sometimes only a dipper or a bucket is available. A much better system is a bucket working up and down with a "mik"; better still is the liquid manure pump. All these different arrangements might be expected to meet different requirements; but generally speaking they are the result of not understanding what is necessary. Much depends on having a properly constructed tank. The extra cost is more than repaid.

A good tank has to fulfil many requirements; these may be summed up in the words economy, convenience, and hygiene. *It must be watertight*, so that no liquid can escape from it or water filter into it. It must be sufficiently large to contain the whole of the urine produced between two consecutive times of application to the soil. (Often the tank is made too small, and then losses inevitably take place, since only a small portion of the urine can be used for "watering" the manure heap). Collecting must be easy so as to avoid unnecessary labour. (This is another point in which many tanks fail). A year's production of liquid manure is very bulky, so that if it is to be used with the utmost profit labour must be avoided as much as possible. When constant manipulation is required part of the advantage of using it is lost. The liquid ought to run into the tank automatically and as soon as possible so as to avoid loss of nitrogen, and any inconvenience. This rapid disposal of it tends to cleanliness, less litter is required, and less waste occurs through the transformation of urea into ammonium carbonate. The liquid must be collected completely so as to avoid loss or stagnant liquid standing in the shed.

For these reasons the tank ought to be situated as close to the standing place of the cattle as possible. When tanks are built out in the farmyard rain water generally leaks in. This occupies space intended for the liquid manure, and increases the volume of the liquid carried to the field without adding to its value. The closer the tank is to the standing-place of the cattle the shorter distance has the urine to run, the less slope is required to carry it off, the fewer pipes or channels have to be cleared, and the higher may the tank be built; so that the liquid will not have to be raised so high and pumping will be easier.

Obviously the tank must never stand higher than the cattle if the liquid is to flow into it automatically. If the cattle stand a little above the surface of the ground so much less soil will have to be removed for the construction of the tank. The latter should be in direct communication with the shed. It should be under cover out of reach of the sun in summer, preferably in a cool place. Also it should be near the manure heap so as to use the urine for "watering" the manure and to facilitate the return of the excess liquid to the tank. Its construction must be simple so that any local man can build it without the help of specialists. It must be placed out of the way so as not to take up space that might be more usefully occupied; it should be easily approachable by a cart, and it should be fitted with a good pump. There used to be a saying in the country; "If you want to clear a man out make him pump and he will run away," but given a shallow tank and a good pump the work is quite easy.

In many parts of Belgium, where tanks are in general use, although not perfect at the beginning, they have been improved little by little, later builders profiting by early mistakes. To prevent a repetition of these mistakes careful investigations were made, and the practical discussion of advantages and disadvantages has resulted in a type of tank which realises the maximum of requirements at the smallest possible cost. These tanks have been made and adopted in the most advanced districts, and the general description should make their construction possible to anyone, though the details may be varied according to personal judgment.

The Tank.

Description and Details of Construction.—The tank is best placed immediately under the standing place of the cattle. It occupies the full width of this standing place—say, about

$6\frac{1}{2}$ ft., and runs the entire length of the shed. A depth varying from 32 in. at the shallow end to 35 in. at the outlet is quite sufficient. If good, solid 9-in. bricks are available, walls of one brick thickness are quite enough and no foundations are required. The bricks are set in Portland cement. The floor is of brick also, because it is cheaper than concrete. To make it water-tight the soil below is first rammed carefully, then the bricks are put

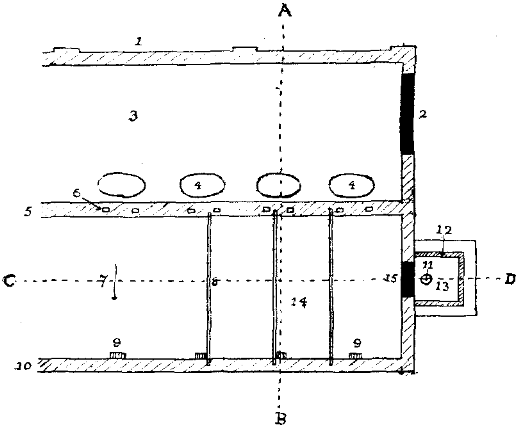

FIG. 1.—Plan of Cattle-House, with Liquid Manure Tank under Standing Place of Cattle, and Outside Hole for Drawing the Liquid Manure.

1. Outside wall of shed. 2. Door. 3. Paved feeding passage. 4. Food troughs. 5. Front wall of tank *(9 in. width)*. 6. *Eyes for tie-chains.* 7. *Paved standing place for cattle,* slightly sloping in direction of arrow. 8. Iron girders 9. Cast-iron grating. 10. Back wall of tank (9 in. width). 11. Pipe of pump. 12. Sunk border bearing the wood cover. 13. Outside hole. 14. Arched brickwork beneath the paved standing place. 15. Hole through wall.

Section A to B is shown in Fig. 2 and Section C to D in Fig. 3.

in place, allowing a little space between them. A coat of cement is then added and worked well in with a broom, the process being completed piece by piece. When the joints are nearly filled the cement is left to harden a little and afterwards the whole of the inside of the tank is cemented, so as to make it entirely watertight. If the soil is very damp and the winter water-level very high, it may be necessary to use concrete, but it will not be so as a rule. The tank is built about half above the level of the soil. This has many advantages. Not so

much soil has to be removed, and that which is can be laid down on the service passage behind the cattle, or the feeding passage, or round the building for earthing up. The emptying of the tank is easier, and the floor of the tank slopes in such a a direction as to make the liquid flow towards the outlet, so that near the outlet the depth is slightly greater than at the farther end. The back wall of the tank must have a height of 52 in.: being 3 in. for the floor, ½ in. for the cement, 35 in. depth of tank, 4½ in. width of bricks used between the iron girders (see later), about 3 in. allowed for the camber, a top layer of one brick, say, 3 in., and one brick forming a border to the lower end of the top. The front wall will be 7 in.

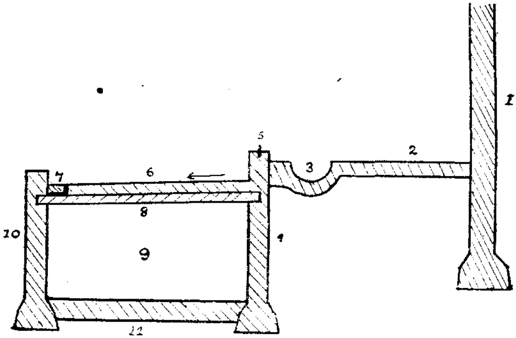

FIG. 2.—Cattle House with Liquid Manure Tank
(Section A to B of Fig. 1.)

1. Outside wall. 2. Paved feeding passage. 3. Food trough. 4. Front wall of tank (9 in. width). 5. Eyes for tie-chains. 6. Paved standing place for cattle slightly sloping in direction of arrow. 7. Cast-iron gratings. 8. Iron girders. 9. Tank. 10. Back wall of tank (9 in. width). 11. Floor of tank.

higher, say two layers of brick and 1-in. slope. For each cow two iron eyes are fixed into the front wall to which to attach the tie chains.

The upper floor or top, which serves at the same time as a standing place for the cattle, is made of brick strengthened with iron girders, or of reinforced concrete. The concrete is made according to the formula 1-2-3 (one part of cement to two parts of sharp sand and three of grit) and is reinforced with small sized T-irons or solid iron netting. Generally the top is made of brick and iron girders. The girders are about 4 in. wide and 7 ft. 4 in. long (fixed about 5 in. into each wall) and are

placed about 32 in. apart, or sometimes a little more. To the brickwork between the girders 3 in. camber is allowed. For building the camber the bricks are used on their sides and not flat. These cambers are masoned with cement, and a straight layer of cemented brick is put on top. If the bricks are good there is no need to cover them with cement. One and a half-inch slope from the front wall to the back wall of the standing place is allowed so that the evacuation of the liquid can be assured. The fall may be obtained by sloping the girders, or simply the upper bricks, and does not affect

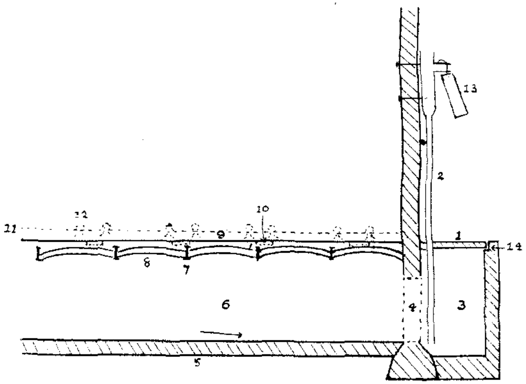

FIG. 3.—Cattle House with Liquid Manure Tank (Section C to D of Fig. 1).

1. Wood cover of outside hole. 2. Pump. 3. Outside hole, 4 in. deeper than tank. 4. Communication hole through wall. 5. Floor of tank. 6. Tank with slight slope in direction of arrow. 7. Iron girder of about 4 in. 8. Arch with about 3-in. camber. 9. Paved standing place for cattle. 10. Iron grating. 11. Front wall. 12. Eyes for tie-chains (10, 11, and 12 are dotted as being outside the section). 13. Movable pipe hanging from spout of pump. 14. Shoulder border.

the animals in the least. It drains off the liquid, which is retained by the upstanding brick of the back wall, at once. There are no gutters or pipes, but just behind each cow there is a small, removable cast-iron grating which lets the liquid pass straight into the tank. The size of the grating is often 5 in. by 5 in, or 6 in. by 6 in., but a brick-form grating would do. A man-hole in the top of the tank permits of cleaning when necessary, and a hole is made in the outside wall for ventilation. If the tank is a long one, a second man-hole might be necessary.

Where many pigs are bred there is a large quantity of liquid manure ; in this case a similar system can be applied. Sometimes a small tank, about one-third yard square, is made and connected with that in the cowshed by means of a pipe near the bottom.

The tank is emptied through an outside hole, which must be situated where it is easily accessible, taking into account the needs of carting, of " watering " the manure heap, and of

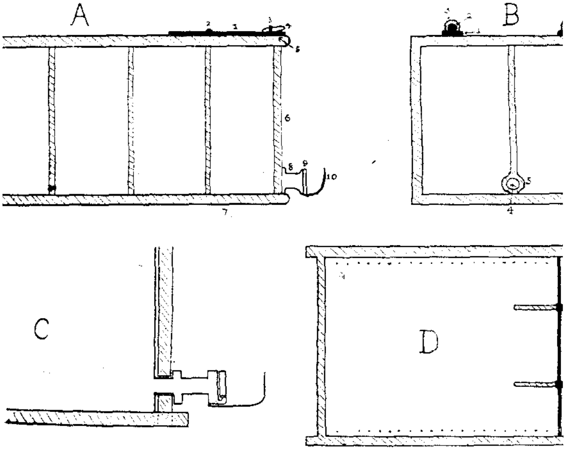

FIG. 4.—Kist (Large Size) for Liquid Manure.

A. SIDE VIEW.—1. Blade. 2. End of door. 3. Hole at end of blade. 4. Staple through hole. 5. Enlarged part of blade. 6. Back. 7. Somewhat stronger framework. 8. Tap. 9. Movable cover. 10. Curved iron spreader.
B. END VIEW.—1. Enlarged part of blade. 2. Staple. 3. Hole at end of blade. 4. Tap. 5. Enlarged part of framework.
C. Enlarged design of tap showing the fitting in the wood and arrangement of movable cover.
D. TOP VIEW.—1. Blades.

recovering the possible excess of liquid used in " watering." If there is a pit or shed for the manure heap possibly the outside hole might be made in it. In the case under consideration it is made so as directly to adjoin the tank. It communicates with the tank through the wall of the shed. There is no need to make it large ; 24 in. by 24 in. is quite sufficient. If larger it would make the approach of a cart more difficult. It is about 4 in. deeper than the tank so that the tank can be emptied

completely. The wall round the hole is provided near the top with a shoulder border, into which a cover is fitted made of a 2-in. piece of oak. A pump of large capacity, so constructed that it cannot be choked is fixed against the wall of the shed right into the hole. It has a pumping capacity of about 100 gal. to the minute. Chain pumps are sometimes used, although a wide-mouthed ordinary pump is to be preferred. The pump

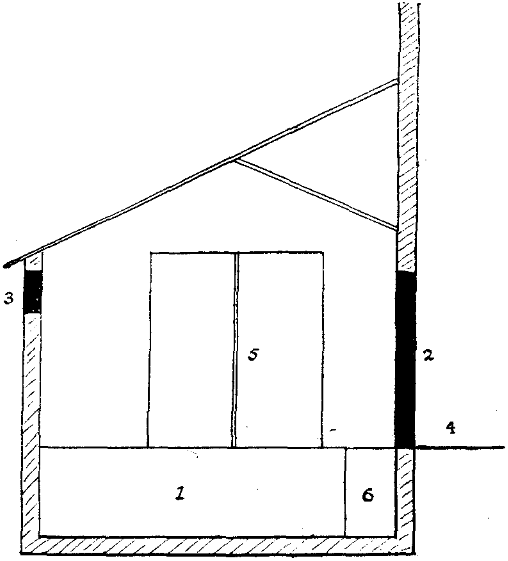

FIG. 5.—Solid Manure Pit adjoining Cattle House.

1. Manure pit. 2. Door between pit and cattle house. 3. Window. 4. Cattle house. 5. Double door. 6. Outside hole of liquid manure tank.

should cost from 30s. to £2. The pump is provided with a pipe reaching close to the bottom of the outside hole so that all the liquid may be removed. It is made of such length and placed at such height that the liquid can be pumped straight into the kist* standing on a cart. The spout of the pump is not long enough to reach into the kist; therefore a movable pipe, made on the spot, of four boards of about three feet in length is fixed

* The term "kist," as used in this Article, means a wooden tank to cart liquid manure to the fields (see p. 1218).—*Ed.*

to it by a wire. The pump should be used also for "watering" the manure heap. It is easily worked by one man. When not in use, especially in winter, the piston and arm are often removed so as to prevent deterioration or misuse.

The Advantage of this Tank.—The tank, being situated under cover, takes up no useful space in the farmyard. It carries off the urine completely and immediately. Neither gutters nor pipes are required; the work of cleaning is, therefore,

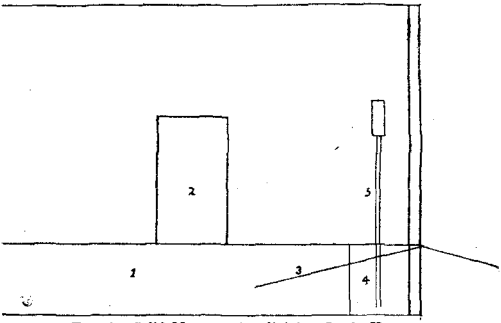

FIG. 6.—Solid Manure Pit adjoining Cattle House.
1. Solid manure pit. 2. Door between pit and cattle house. 3. Slope. 4. Outside hole of liquid manure tank. 5. Liquid manure pump.

reduced to a minimum and the shed is always clean. There is an important economy in litter through the prompt removal of the urine; the handling and "watering" of the manure heap are simplified. Being situated rather above the level of the ground very little soil need be moved for its construction, so that there is small fear of water coming in, and the floor may be made of bricks. Again, the liquid does not need to be pumped high. The construction of the tank is not expensive, considering that the top provides an excellent standing place for the cattle, and, being shallow, no foundations are required. No losses can occur and the tank is easily emptied. Hand labour is saved everywhere. Being emptied outside nothing is soiled in the process.

A kist is used to carry the liquid to the fields. An iron tank is inadvisable because it is cumbersome to handle, and also would need much keeping up, as only cast iron would resist the action of the urine. Sometimes kist carts are used, but on

ordinary farms they are not recommended because naturally they would cost much more, cannot be put to other uses, and occupy too much room in the cart shed. As mistakes have also been made in the construction of the kist some practical hints may be useful to the farmer.

Description of the Kist.—The kist is a wooden tank almost exactly fitting the inside of the farm cart on which it is placed. It is, however, about 6 in. longer so as to project slightly over the back of the cart. It contains generally from 150 to 220 gal. It could be larger, but then it would no longer be easy to handle, and its weight might injure the crops over which it is taken. For one horse a capacity of about 175 gal. is most practicable on the field. The kist is made of an oak frame and deal planks. It is obvious that the framework must be outside, and that on the top none is needed. The oak used is 2 in. thick, the deal ½ in. for the sides and bottom, and 1 in. for the top. A door through which the liquid is pumped in is made at the back of the top. This door opens from the back and fits at the half-wood of the frame, to which it is solidly attached by two long-bladed hinges. One arm of each blade extends right across the door, and ends at the front in an enlarged piece through which a hole is pierced. A staple passes through the hole and is secured by a peg attached to the door by a little chain. The door occupies about a quarter of the top of the kist. It must be strongly fixed and must fit as closely as possible. To prevent the shaken liquid oozing through the cracks, a piece of old sacking is spread over the opening and the door closed down on it. The kist is provided with a hole or a tap for the purpose of spreading. The hole must be made in the bottom, right in the middle and close to the back end. A stick as long as the kist is deep and a little thicker than the circumference of the hole, sharpened off at one end, closes the hole up. Another piece of sacking over the point is sufficient to make it watertight. The stick is fixed in the hole, inside of course, before the kist is filled, and is simply removed for spreading. As the kist projects beyond the edge of the cart by about 6 in., the liquid pours through the hole and falls on a board fixed in a sloping position underneath the cart, and is quite evenly spread over a width of about 2 yd.

The best system, however, is a cast iron tap fixed close to the bottom at the back of the kist. It is closed on the outside by a removable cover, and the spreading is produced by the action of the liquid spraying against a curved iron plate placed before the opening. This tap costs only about 4s.,

and is a most efficient spreader. After being used the kist is easily removed from the cart, and cleaned out with a few buckets of water. It must be stored in a shed out of reach of the wind or will soon be useless. During dry, hot weather it is sometimes covered with wet bags, or partly filled with water.

Spreading in the Field.—The horse must be led at a good pace. When the pressure falls, through the decrease of the liquid in the kist, the forepart of the cart is slightly raised by means of a stick placed between the cart and the shafts. This ensures a complete emptying of the kist and a good spreading of the liquid till all is used.

The Uses of Liquid Manure.—Liquid manure is used on many crops. At the end of the winter or in early spring it is spread on grass land. It is often applied as a top dressing to winter corn. Later it is carted to fields for mangolds and swedes, which crops it suits very well. It is not so suitable for potatoes on account of the poorer quality tubers it produces when used too freely, but it may be applied in moderate quantities. Again, it is used on grass land after the first cut, and also on catch crops, on turnip land before sowing and on carrots as a top-dressing. It gives good results when applied to fruit trees, and also to cabbages.

The Manure Heap.

Although considerable improvement has been made in some cases in recent years the manure is still carelessly treated. It often remains in the stable for an indefinite time and is afterwards turned out into the farmyard. Here it accumulates haphazard in an irregular heap, neither dressed nor compressed, and strewn all over the place. Each time the cow house is cleaned out the heap spreads. Sometimes the manure of the different kinds of stock is even collected close to their respective stables or sheds, each heap being formed according to the fancy of the farm hand, whose chief idea is to get rid of the manure with the least possible trouble. Poultry scratching on the heap scatter the fresh manure every day and spread it still more. The result is that the sun, rain and wind have free access to it and carry away the best of its constituents. The sun causes fermentation which heats the interior of the heap, hastening the loss of humus and nitrogen through the transformation of nitrogenous matter into ammonia, which escapes into the air. When anærobic white moulds are formed the losses are very large. The outside of the heap on the other hand becomes dry and strawy. In spite of this its soluble con-

stituents are dissolved and carried away by the rain, as those of the inside are by the blackish brown liquid flowing from the heap. This liquid contains the soluble humus (amides) as well as a large proportion of potash, and the formed nitrates, these representing the greater part of the value of the manure.

Some farmers still need convincing that the care of the manure counts largely in the prosperity of the farm. Fortunately in some places measures to improve matters have been adopted. Sometimes an open manure pit is used. This, however, is not advisable. Either the floor is permeable, so that harm is done by the great mass of water soaking the heap and passing into the drains, or the floor is impermeable and the liquid prevents proper maturing, whilst sometimes the pit overflows.

On other farms concrete platforms are adopted. In this case, however, the outside of the heap is still exposed to the wind, to rain, and partially to the sun; while very often, through lack of moisture, white moulds occur, burn the humus, greatly reduce the bulk of the manure, and cause heavy losses of nitrogenous fertilising matter. White moulds should be prevented: in some countries their presence is regarded as an unmistakable sign of bad farming. Sometimes the manure heap is covered with earth. This is a very good practice if the earth layer is complete and about 4 in. thick, as the soil catches the liberated ammonia and so reduces the loss. But it is a troublesome method; the liquid still escapes and ripening is not carried on in the best way. By all these methods the injurious influences, although diminished, are not eliminated, or even reduced to their minimum.

The management of the solid manure is so important that considerable attention has been devoted to it in many parts of Belgium, and greatly improved conditions of preservation and maturing have been brought about. The following points were taken into consideration:—

(*a*) Easy handling of the manure.
(*b*) Shelter from rain, sun and wind.
(*c*) Improvement of the process of ripening.
(*d*) The avoidance of white moulds.
(*e*) Improvement of hygienic conditions, and also the appearance of the farmyard.

Practically all these points have been considered in the following system:—

A solid manure pit is made against the wall of the cow-house, running the whole length of the building. Its capacity is

calculated on the quantity of manure produced between two successive emptyings of the pit, its width often being 3½ yd. The pit is sunk into the soil so that the influence of the atmosphere is reduced to a minimum, the depth being about 32 in. It is made watertight by a cemented brick or concrete floor, and completely closed in by a wall with a lean-to roof, so that neither rain, sun nor wind can reach the manure. The walls are cemented up to the level of the soil. Windows are provided, but are darkened during summer. A door for each three or four cows is cut in the wall between the shed and the pit, so that the solid manure can be taken from the shed and thrown directly into the pit. The manure is trodden by cattle, calves, or horses leaving and returning to the shed or the stable. This treading is necessary to keep the air out. Sometimes the manure shed is used at the same time as a cart shed, the carts also helping to press down the manure. A double door gives access to the yard for the purpose of carting, the carts going into the shed on a slope. The necessary ventilation is provided by means of the windows or ventilators in the roof.

The solid manure is "watered" with the liquid manure, and for this operation the liquid pump is used. It should be noted that it is necessary to "water" the manure for the purpose of ripening, preventing heating, and keeping out moulds. The effect of liquid manure, instead of impoverishing the contents of the pit, as pure water would, is to improve them. Nothing is spoiled, losses are reduced to a minimum, nothing is seen of the manure from outside, and the yard is clean. The outlay is repaid in a short time. Besides this the breeding of flies is checked, since the doors are kept closed, and flies have but little access to the manure. Moreover, as the windows are darkened during summer, and flies do not like the dark, they are not tempted to go into the pit.

In farms already occupied the pit is built for the greatest convenience, so that the different manures may be kept together, and in new buildings arrangements are made to this end.

TARRED FELT "DISCS" FOR PROTECTING CABBAGES AND RELATED VEGETABLES FROM ATTACKS OF THE ROOT FLY.*

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The cabbage-root fly (*Chortophila brassicæ*) is one of the worst pests with which growers of cabbages, cauliflowers, and related vegetables have to contend. In addition to causing widespread damage in the British Isles, it is also prevalent on the continent of Europe and in many parts of the United States and Canada. The fly is an ashy-grey coloured insect, not unlike the house-fly in general appearance, and measures about ¼ in. long. The winter is passed in the pupa stage, and the first brood of flies appears in April or the beginning of May. There are most probably three generations in the year. The eggs are visible to the naked eye, and are laid close to or on the plant, usually just below the surface of the soil. The larvæ are typical fly maggots, of white or pale yellowish colour, and measure about ¼ in. in length when full grown. They commence injury by gnawing the outer layers of the young roots, afterwards making tunnels inside the main root; they may also invade the lower part of the stem. The pupæ are about $\frac{1}{5}$ in. long, oval in form, of a light or dark-brown colour, and are found in the soil close to the plants.

As the result of the attacks of the maggots of this insect, growth of the affected plants is checked, the leaves flag and become discoloured, the roots are largely destroyed, and the plants die.

Many remedies have been suggested either for destroying the maggots, or for preventing the fly from depositing her eggs near the plants. With very few exceptions none of the known measures can be recommended as being sufficiently practical and efficient to merit adoption. In a recently-issued article on this insect, Gibson and Treherne† record having experimented with 48 different methods of treatment for combating this pest. They conclude, however, with the statement that the only protection to be relied upon in the case of cabbages and cauliflowers is the use of tarred felt

* The illustrations accompanying this article are from photographs taken by Mr. J. T. Wadsworth, and are reproduced by permission of the editor of *The Annals of Applied Biology*.

† *Bulletin 12, Dominion of Canada Dept. of Agric., Entom. Branch*, 1916.

FIG. 1.—Photograph showing appearance of the Cauliflower Plot on 4th July. Rows I. and III. (counting from the field on the left side of the photograph) were protected with Tarred Discs; Rows II. and IV. were unprotected. The remaining rows of plants were not utilised in these experiments.

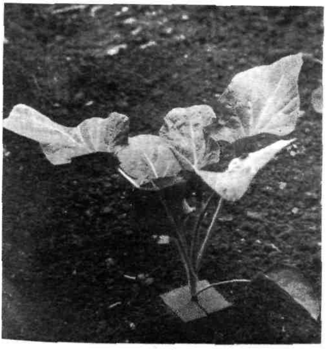

FIG. 2.—Photograph of a Brussels-Sprout plant showing Disc in position.

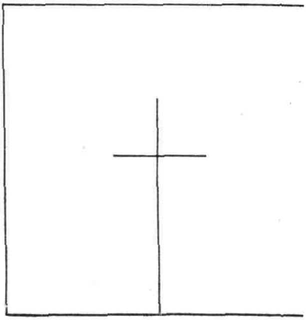

FIG. 3.—Outline figure of a Disc; actual size.

paper discs.* Professor Goff,† of Wisconsin, was the first to adopt these discs or protectors, and found them to be thoroughly reliable and practical. His method soon became widely adopted in North America, where the discs have been frequently tested on a large scale, with favourable results. In the British Isles the discs have never received the attention which they undoubtedly merit. Reports on their use are extremely few, and they have not previously been subjected to any exhaustive trials.

During the past season a series of critical experiments has been carried out in several localities, under the writer's direction. The most important trials were those undertaken by Mr. J. T. Wadsworth,‡ Research Assistant in the Department of Agricultural Entomology, Manchester University. These trials were conducted at Northenden (Cheshire) on land which was known to be heavily infested by the root fly. They were made on both cabbages and cauliflowers grown on well-manured soil. Some 816 cabbages (Leeds Market variety) were planted out on 1st May, and the discs placed in position on the following day. The latter were obtained from America and are 2½ in. square. Each is provided with a slit extending to a point ½ in. beyond the centre of the disc, and a shorter slit crosses it at right angles in the centre of the disc (Fig. 1).

In order to obtain good results, it is desirable that the soil should be in a friable condition to enable the discs to be placed quite flat on the ground. They must be placed round the stems of the plants as soon as possible after the latter are planted out in the field (Fig. 2). Failure to take this precaution often results in the plants becoming infested prior to the discs being applied, and the value of the latter is then lost. In the case of vegetables planted out earlier than May, this precaution is not so urgent, but the date of appearance of the flies varies according to the prevailing climatic conditions, and the location of the particular district concerned.

The main function of the disc is to act as a mechanical device to prevent the flies from laying their eggs in the usual position, close round the plants. It is, furthermore, important to keep the surface of the discs free from soil, otherwise the insect will deposit its eggs thereon, and the young maggots will readily gain access to the protected plants. Of the 816 plants used in Mr. Wadsworth's experiments, half were pro-

* These "discs" are really square-cut.

† *8th Annual Report, Exp. Sta., Univ. of Wisconsin, 1891*, pp. 169–173.

‡ For a full account of these experiments, *vide* J. T. Wadsworth, *Annals of Applied Biology*, Vol. III., No. 2, 1917.

vided with the discs, and the remainder left unprotected. Only one plant was lost out of the 408 protected plants, while 54 of the untreated cabbages were severely attacked. With regard to cauliflowers the results were even more striking; 932 plants were utilised and, similarly, half of these were protected and the remainder left unshielded as controls. Only 24 of the protected plants were lost as compared with 294 of the unprotected plants (Fig. 3).

In addition to experiments by Mr. Wadsworth three market-gardeners undertook small scale trials. Full instructions were given in each case as to the method of application and the use of the discs. One grower, at Chorlton-cum-Hardy (near Manchester), who was supplied with 100 of the discs, reported that no case of root-maggot attack was noted where they were used, and that so far as his observation went they were successful. Another grower, at Prestwich (Cheshire), wrote that he had applied the discs to 50 cabbages and, out of those, only 2 were attacked. Of 50 control plants most were infested. The third observer (at Nottingham) applied 100 of the discs, and reported that out of 84 protected cauliflowers only 5 were apparently attacked, and none were lost. Of 20 unprotected plants 12 survived. He also experimented with 36 Brussels sprouts, 6 of which were provided with the discs. These all produced strong healthy plants, while all the unprotected ones were affected, 5 being completely destroyed.

Growers of cauliflowers and related vegetables are strongly advised to give these discs a fair trial. Their application is extremely simple, and can, if necessary, be undertaken by children. If they are placed carefully on the plants no further attention as a rule is necessary. Once the plants have made good growth they have been tided over the most vulnerable period, and the soil can be earthed up over the discs, as the latter are then no longer necessary. The use of the discs is not the only measure advisable. The custom of cutting the vegetables and leaving the stumps to decay should be discontinued. The plants should be uprooted straight away in infested lands, as their stumps only serve as breeding places for fresh broods of maggots.

Arrangements have been made for the discs to be manufactured and sold at 1*s*. per 100, or 8*s*. per 1,000. The address of the maker may be obtained on application to The Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

ILLUSTRATION FARMS IN CANADA.

IN the Seventh Annual Report for 1916 of the Canadian Commission of Conservation, Dr. James W. Robertson presents a statement of the general results obtained through the "Illustration Farms" which were arranged for by the Committee on Lands in the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island. The scheme of these Illustration Farms is quite distinct from that of the Experimental Farms which for a number of years has been a marked feature of the work of the Canadian Department of Agriculture It is also clear that there is no work being carried on in Great Britain analogous to these Illustration Farms in Canada. Dr. Robertson says: "Visits to some of the Illustration Farms, examinations of the records in detail, and consideration of all the reports from the Illustration Farmers themselves, have given me great satisfaction. Of the many movements for the welfare of the farmers, and the advancement of rural life generally, in which I have had the good fortune to take part, I do not recall any single undertaking which has been more entirely successful in accomplishing the objects aimed at than this one of the Illustration Farms."

The selection of the Illustration Farms and the work attempted on them grew out of the survey of farms conducted by the Committee on Lands in 1911–1912. In the main, the survey was undertaken to discover existing conditions as to: (*a*) the fertility of cultivated farm land and its maintenance, increase or decrease as the case might be; (*b*) the prevalence of weeds; (*c*) other hindrances to profitable and successful farming; and (*d*) the methods and systems in use in carrying on farming effectively and satisfactorily. In the provinces concerned 885 farms were surveyed. These were in groups of about 30 contiguous holdings, each group being chosen to represent a district of the province in which it was situated.

As a result of the survey, many striking instances of particularly good farming were brought to light. Some farms emerged from the level of the others, not so much because of their better soil as because of better planning, better systems, better methods, and, above all, better management. From among the best of such farms in each group a selection was made of one to become the Illustration Farm for the locality. There were thus obtained, in the five provinces mentioned, twenty-four Illustration Farms. The survey established the fact that on these farms some

measure of care and intelligence was used in the selection of seed grain, and some system of rotation of crops was at least partially followed. On the farms thus chosen, more satisfactory results, on the whole, had been obtained in crops and in profits than on most of the other farms in the group.

The farmers themselves, in each group, in conference with the Commission's expert, chose the farm in their community upon which they could have illustrations of further improved methods of farming. These, when proved to be beneficial, were to be applied to all the farms in their district. The farmer chosen retained his ownership and full control of his farm. At the same time he received counsel as to systems of rotation and methods of cultivation, the selection of seed, the growing of clovers and grasses, etc., but the general administration of the business affairs of the farm was controlled entirely by the Illustration Farmer himself. He received all the financial returns resulting from the better crops. The illustrations benefited the community also. The arrangement with each Illustration Farmer was to last until he had harvested three crops. By the end of the third year, that is, at the end of the season of 1915, the Committee were entitled to learn from the farmer his opinions and conclusions as to whether the plan had worked out satisfactorily.

The Illustration Farmers were assisted by expert advice from the Committee on Lands for two years, taking in the crops of 1913 and 1914. In order that results might be obtained without unnecessary loss of time the Committee decided to grant a limited amount of assistance to each farmer to provide (1) a supply of seed grain of suitable varieties and of selected quality; (2) the quantities of clover and grass seed recommended above those required at the rates per acre previously sown; (3) trials, on limited areas, of after-harvest cultivation, seeds, manures, etc.

The plan of work for each farm was made to suit its conditions. The plan was made by the Illustration Farmer himself, in each case after conference with the Commission's advisers. The frequent visits made by these advisers assisted the farmer to modify, from time to time, the general plan of work and the methods of its application. In general, the scheme of co-operation between the advisers and the farmer included consideration of the following matters:—

The planning, beginning and carrying on of a suitable systematic rotation of crops for each farm and its neighbourhood.

The sowing of the varieties and strains of grain suitable to the farm and the district.

Different rates per acre to ascertain the most suitable rate of seeding.

The sowing of different amounts per acre of clover and grass seed, to ascertain the most suitable rate of seeding of both home-grown and purchased seed.

The sowing of various summer pasture mixtures

The practising of after-harvest cultivation, extra and more thorough cultivation to kill weeds, conserve moisture and increase yields.

The introduction of labour-saving devices and up-to-date machinery.

The care and economical use of farmyard manure.

The encouragement of a farm garden.

Directly and indirectly encouraging many other means of making the farm more profitable, the farm life more satisfactory and pleasant, and to help to keep the young people on the farms.

Statements were received from twenty-three out of the twenty-four farmers in the eastern provinces who were doing illustration work. In order to find out whether these farms were a financial success, a series of questions on the subject was put to the farmers, and the replies of twenty-three of them are summarised below.

Advance in Crop Rotations.—Twenty stated that they were now practising a more suitable and systematic rotation than they did previous to commencing work with the Commission three years before. Every farmer who had improved his rotation system said that it had increased his crop yields. Several stated that there had been an increase but could not say how much, while twelve estimated a definite increase, the average of which was 19 per cent. It should be borne in mind that before starting the illustration work these farmers were already among the best in their districts.

Varieties of Grain Sown.—Sixteen of the farmers stated that they had not been sowing the varieties and strains of grain on their farms which would give the best results, and eighteen said they were now sowing varieties more suitable to their farms and their neighbourhood. Only three claimed to have been sowing selected seed before beginning work with the Commission, while every man was now sowing selected or registered seed, and they said that it paid them in bigger and better crops.

All the men said that good seed had become something of much greater importance to them than previously, and this is a fact which cannot fail to have lasting and far-reaching results in each community. From the many expressions of opinion given by the Illustration Farmers, the following may be quoted:—

(*a*) "Three years ago I thought I was sowing good seed; now I find it pays to sow the best that can be had."

(*b*) "We have not changed varieties of seed, but we are now sowing nothing but registered seed. We find we have better results, and it pays."

(*c*) "The tests with corn have proven to us that it is cheapest to buy the best seed corn possible; it matters not what the price may be."

(*d*) "I am now sowing the best of seed, whereas I used to sow seed of inferior quality. This is one way the Commission of Conservation has helped, not only me, but a number of neighbours, in obtaining good seed grain."

(*e*) "We have been sowing selected seed for the past eight or ten years; on the average our yields have been fully 50 per cent. greater than they were before."

Rate of Seeding for Best Results.—The question of the amount of grain to sow per acre to get the best results had not received much attention from the farmers, and many did not consider the condition of the soil when determining the amount. Thirteen stated that they knew now that the amount previously sown was not suitable, and had changed their rate of seeding. Every farmer said he had found that cleaned and selected seed did not require to be sown so thickly as uncleaned seed, and that soil conditions should determine to a considerable extent the amount per acre to be sown. A number had previously given this point a little consideration, but ten had not thought of it at all before the visits of the Commission's travelling instructor. One farmer reported: "We have found that the richer the land the smaller is the quantity of seed needed, and where the land is poorer a heavier seeding is needed. We formerly seeded it all the same."

Sowing of Clover Seed.—Only two of the farmers claimed to have been sowing their clover seed thickly enough to ensure a good take. Twenty-one had been sowing an average amount of 6 lb. to the acre, whereas they now sow 10 lb. Some had sown as little as 3 lb. or 4 lb., but were now convinced that 10 lb. were better and were sowing that amount. Three farmers had previously grown their own seed, while now twelve were regularly doing so. One farmer stated:

"The high price of clover seed had something to do with our sowing a small amount, but since growing our own seed we do not mind sowing it heavier, and find that the extra seeding more than pays for itself." Another farmer, who had not previously grown his own seed, stated that in 1914 he produced 500 lb. of alsike seed and 100 lb. of red clover, while in 1915 he grew over 1,000 lb. of red clover seed. The farmer doing illustration work for the Commission in Lanark County, Ontario, in 1914, grew 1,200 lb. of red clover seed and had never grown a pound of his own seed previous to commencing work for the Commission. Another report said: "During the last two years the first crop of hay was always much better on the area sown with 10 lb. clover and 10 lb. timothy, while this year we have an unusual stand of clover in the plots heavily seeded. . . . . We find the second crop is always much thicker and of a better quality after the thick seeding."

After-Harvest Cultivation.—Five of the farmers had been practising after-harvest cultivation previous to the visits of the Commission's instructor, while since his visit twenty have been practising it. Eighteen stated that it had helped them to keep down weeds, and that it had increased their yields and the profits from their farms. Some of their statements are as follows:—

(*a*) "Our experience with after-harvest cultivation has proven to us that it helps greatly in keeping down weeds, and the land is in a better condition to withstand the drought the next year."

(*b*) Following clover-seed production and seeding, this is, in my opinion, the next most important illustration. We find it pays from every standpoint and, as proof that this part of the work has been noticed, many of the farmers in this district are demonstrating its value for themselves and the acreage is yearly increasing. Three years ago this was not done."

(*c*) "If one wants good crops he has to gang plough and cultivate after the harvest."

(*d*) "After-harvest cultivation was not practised in this community until three years ago; and now many farmers are doing quite a lot of it, and find it very profitable, for it mostly ensures a good catch of grass and clover, leaving the land porous and fertile."

(*e*) "I notice a good many of my neighbours are taking up this practice."

Labour-Saving Implements.—Eighteen of the farmers said they were making more use of labour and time-saving devices than before; fourteen were using wider implements; twelve were making more use of three- and four-horse teams; while twenty stated that they now planned and adjusted their work to utilise better the help on the farm. Some of their statements are:—

(*a*) "Having used a three-horse team I find that it is a decided advantage."

(*b*) "We have arranged our work so as to be able to employ all our help by the year."

(*c*) "We find that up-to-date and improved machinery and methods are profitable in all ways."

(*d*) "When I have to renew my implements I get wider ones, for I think the wide implements are more successful."

Application of Manure.—Fifteen of the farmers stated that they were now applying their farm manure in a manner by which better results could be obtained than formerly. Eighteen of the farmers were now exercising more care in preventing waste. Twenty stated that they recognised more fully the value of the manure than they did before the visits of the Commission's instructor.

(*a*) "For the last two years we have been trying different methods of applying the manure and find it very interesting. We will have to continue for a few years yet to find out which is the best way, as I believe the seasons have much to do with it."

(*b*) "I am exercising care to prevent waste, and I appreciate more the value of it."

Farm Gardens Receive More Attention.—Twelve of the farmers stated that they had always paid some attention to the garden, but eighteen said that they were now doing so to a greater extent, and that it paid them.

(*a*) "We have always kept a good garden, but we are now paying more attention to the securing of better varieties of seeds and plants."

(*b*) "I find the young people taking an interest in and enjoying the farm work more since the garden has been improved."

(*c*) "The garden is the place where we train the young people to work on the farm and enjoy it."

Increasing the Attraction of the Farm.—Twenty-two of the farmers said they were now taking more interest in their farm work generally than before. Seventeen said that their young

people had become much more interested. Every man stated his conviction that it was necessary for him to try things on his own farm to see what was really suitable to his farm and community. Twenty-two of the farmers stated that their farm profits generally were greater than before.

(*a*) "The satisfaction of trying things out for yourself, and seeing results, is bound to increase a person's interest in his work, and the illustration work conducted by the Commission on our farm has shown us what can be done."

(*b*) "While we have been working under the Commission we have found it a great pleasure to try out these illustrations, and the young people have taken more interest in the work on the farm."

(*c*) "We find, as the years pass, the work more interesting and instructive; and believe that it has been productive of great good throughout the surrounding country. Besides, scores of farmers have made inquiries and are deeply interested in clover-seed production and seeding, which is also practically a new thing in this part of the country."

(*d*) "The illustration work on the field at the road has called forth the attention of the community at large, and it has proved to them, as well as to ourselves, that a four-year rotation is a very profitable one. They stop to inquire how it has been worked and seeded and are trying to copy it as far as possible."

(*e*) "During the past summer I observed that the public was very much interested in your Illustration Farms. I received many visitors and I noticed that my illustrations were profitable to all."

(*f*) "I am more attentive to my work in every way. The young people have a garden of their own. My farm profits are about 30 per cent better."

(*g*) "Results: better seed, better cultivation, and better prices, from having a good article to offer."

The Illustration Farm work was transferred to the Dominion Department of Agriculture in the spring of 1915, at which time a new division was organised, known as the Division of Illustration Stations, with headquarters at the Central Experimental Farm, Ottawa. The illustration work has been considerably extended during the past summer by the Division of Illustration Stations. Fifteen new stations have been started in each of the provinces of Alberta and Saskatchewan, with nine in Quebec.

OPEN-AIR PIG-KEEPING IN GLOUCESTERSHIRE.

F. PETER.

THE following notes are not submitted with the object of advising experts as to the management of their business, but simply to focus attention on a well-known and thoroughly tested principle; it must be left to the judgment of the reader as to whether any of the points raised can be adopted with advantage in his own circumstances.

The subject of out-door pig-keeping has assumed increased importance in the light of the present national circumstances. The many and urgent appeals to farmers for food production, men and money at one and the same time make it difficult to decide the relative importance of the three factors. There is, however, no doubt of the outstanding necessity for producing more food at the earliest possible date.

The production of meat, only, will be considered in this article, but the need for not encroaching on land capable of growing cereals will be kept in view. A heavy demand on skilled labour and feeding stuffs is also undesirable.

The question which first arises is: What class of stock can best be placed on the market in greatly increased numbers at an early date? In this connection, the pig holds an undeniable position. Unfortunately the pig is becoming unpopular through no fault of his own, but owing to the ever-increasing price of barley meal. Numerous inquiries made in many districts suggest that the pig population is undoubtedly decreasing. The price of barley meal and of feeding stuffs generally is not the only objection which may be raised to pig-keeping; the chief difficulties appear to be as follows:—

1. The high price of feeding stuffs leaves practically no profit on the fattening of pigs unless a considerable quantity of house refuse can be obtained cheaply, and this is only available in sufficient quantities in limited areas.
2. A large increase in the number of pigs would tend still further to increase the cost of food stuffs.
3. The price of the bacon pig is usually most unstable, and the risk of a fall in prices is always a serious question for the pig-keeper.
4. The existing accommodation is insufficient, and the cost of the provision of buildings at the present time is prohibitive.
5. Owing to the defective system of draining pigsties, and the usual methods of dealing with the manure, the loss of the

manurial constituents of purchased feeding stuffs is excessive.

6. The risk of loss occasioned by contagious diseases.
7. The risk due to the use of unsuitable and dangerous foods.

In dealing with these questions, the subject will be treated generally and a particular instance stated subsequently.

1. In considering the question of feeding stuffs it is difficult to find any article that has not increased in price, and several have disappeared from the market altogether. The agriculturist is fortunate, however, in being a heavy purchaser of one exception to this rule, namely, pasture. The question then arises, will it pay to keep pigs on pasture? Two factors are deserving of consideration :—

(*a*) The profit to be obtained.
(*b*) The value of the improvement of the pasture.

(*a*) In arriving at the profit to be made on the pigs the quality of the pasture has, of course, to be taken into account. There are seldom two pasture fields on a farm of equal value, and pigs, like other animals, naturally appreciate the best, and the quantity of purchased feeding stuffs is consequently dependent on the quality of the grass. To give a concrete example of what can be done under very moderate conditions, it was possible last summer to make a profit of 43*s*. per head on grazing pigs for three and a half months and finishing by three weeks in a sty. This was done on a very poor pasture in an exposed position at an altitude of over 700 ft.

(*b*) The improvement of pasture on which pigs have been fed is most marked, and it is doubtful if there is any more successful method of improving a poor pasture or an arable field which has fallen down to grass than to fold pigs on it. Instances of this are frequently met with, and in one case a farmer has himself admitted that the rental value of a field had increased in four years from 5*s*. to 25*s*. per acre.

2. The increase in the number of pigs which can be maintained on pasture as compared with the number which can be maintained in sties on an equal quantity of food is rather over 30 per cent. This figure is based on the results of a considerable amount of practical experience which tends to show that a pig fed in a sty requires an additional quantity of at least 200 lb. of barley meal to attain an equal weight to a pig running on grass. Assuming that one million pigs could be grazed, the quantity of barley meal thereby rendered available for other purposes, compared with a million pigs fed in sties, would be approximately 100,000 tons—a consideration of

great importance. (Barley meal is here taken as an illustration; the corresponding quantities of other foods may be calculated on their feeding values.)

3. The variation in the price of the bacon pig cannot be adequately dealt with in these notes. It is a matter which should not present insoluble difficulties if taken in hand by a representative body of producers. There appears to be little, if any, risk to feeders in the immediate future.

4. The present pigsty accommodation is certainly insufficient, and in too many cases unsatisfactory. This difficulty can be met by using whatever accommodation is available for "finishing" pigs, possibly in a period of three weeks. All pigs, including sows and gilts, may be allowed to run on pasture if shelters are provided for them.

The best method of housing is that of wooden huts on wheels, each hut accommodating eight store pigs. The cost of substantial huts for this purpose in the spring of 1916 was £7 each. Shelters constructed of double thatched hurdles prove equally suitable, but are troublesome to move. It may be mentioned, however, that in the summer months, when it is desired to close-fold either on pasture or on forage crops, the movable house is a necessity. For fencing purposes the ordinary ash sheep-hurdle has proved sufficient, and when the pigs have plenty of green food they have no inclination to interfere with the hurdles.

5. It is unnecessary to discuss the question of the loss of manurial constituents of feeding stuffs consumed in our farm buildings. It is only too evident how much of the farmer's money finds its way down the nearest ditch leading from the homestead. When feeding stuffs are consumed by stock actually on the land the loss is reduced to a minimum.

6. Pigs appear to be particularly liable to contagious diseases, and it is generally agreed that pigs, like poultry, thrive best in small lots. When these small lots are carefully arranged and have sufficient fresh air, fresh grass and (by no means the least important) fresh earth, the risk of disease is considerably minimised. When a farmstead becomes infected with disease there appear to be only two courses to follow: the pigs must either be killed off or transferred to the fields as far distant from the infected buildings as possible. Under present conditions the latter course is worthy of close attention.

7. The risk of loss from unsuitable or dangerous foods is a special subject which cannot be dealt with here. The danger is serious to pigs both in sties and on grass, but the latter have the advantage of many counteracting influences.

Advantages of Open-air Feeding.—The advantages of open-air, as compared with sty feeding may now be shortly stated as follows :—

(1) The capital expenditure is small, being for hut and hurdles approximately £1 per pig.
(2) The grass substituted for the 200 lb. of barley meal remains at pre-war price (say 3*s*. per pig on the average).
(3) There is no waste of manurial constituents.
(4) There is less risk of disease.
(5) The number of pigs usually maintained can be materially increased.
(6) The pasture is greatly benefited, and cattle soon graze closely where pigs have been folded.

The advantages enumerated apply to the summer season in particular. The chief and perhaps only disadvantage is that if a breeding herd is maintained sufficient to supply the greater number of the pigs required in the spring, there will be autumn pigs to deal with, and a large stock of pigs in the winter is by no means an advantage. It should not, however, be assumed that pigs in the winter do not pay, but the grass which is such a valuable adjunct to the purchased foods must be replaced to some extent by roots, and roots at present involve considerable expense.

An Example of Pasturing Pigs.—In the case of a pen of pigs, in a demonstration arranged by the Gloucestershire County Council, on a poor exposed pasture on the Cotswold Hills, the following particulars may be given :—

The pigs were bred from a Berkshire sow by a Gloucester Old Spots Boar. They had been running on pasture since they were six weeks old. The purchase price at about ten to eleven weeks old was 35*s*. per head. The pigs were folded on pasture from 20th May to 31st August. After three weeks in sties they were fit for sale. The figures per pig are as follows :—

		£ s. d.
Capital expenditure for hut and hurdles ..		1 0 0
Area required 15 perches.		
Sale price of pig		8 0 0
Cost price	£1 15 0	
Barley meal, 1¾ sacks .. Sharps (middlings), 1¾ sacks ..	4 0 0	
Rent	0 2 0	
	———	5 17 0

If 3*s*. be allowed for interest (at 5 per cent.) and depreciation (at 10 per cent.), on the outlay for huts and hurdles there is a profit of £2, which must be subject to risk of loss by disease or accident. There is, however, a considerable asset in the improvement of the pasture.

Pigs may be kept on the pasture throughout the year, but in winter the grazing should be supplemented with roots.

Breeding sows should be always at grass except when near farrowing, when it is more convenient to have them in or near the farm buildings. When on grass they may be supplied with 1 lb. of maize per day, and when with litter a few pounds of sharps, and any corn which can be spared for them should be added.

The most convenient size for field huts is 6 ft. 6 in. wide by 7 ft. or 8 ft. long. Wheels are an expensive item, but these, or slides, should always be provided. The main point in the construction is to have a strong framework and floor; for the rest ½-in. boarding is sufficient. Short straw or sawdust should be used for bedding. It is particularly noticeable how clean a pig really is when provided with a dry and respectable dwelling. The labour necessary in caring for pigs at a distance from the farmstead may at first sight appear to be a disadvantage, but it must be remembered that feeding is only required twice a day and can be undertaken by women. There is no labour in cleaning sties. If a large number of pigs are kept it is most convenient to mix the food at the foodstore in a tub on wheels, which may be fitted for a pony or donkey. In the case of small numbers the meal may be carried out to the field in a dry state and the mixing done at any convenient water supply.

It is generally believed that pigs at once turn their attention to deep cultivation when turned on to pasture, but most breeds of pigs are naturally grazers, and when provided with any usual form of pig-ring cause practically no damage either to the turf or to any fencing of a moderately substantial nature.

The writer has attempted to discover the disadvantages in this method of pig-keeping, but has been unsuccessful. Why is the method not more generally adopted, and why is such large expenditure incurred on permanent and elaborate pigsties?

Pork Production by a Cornish Small Holder.

MR. JAMES W. LAWRY has communicated to the Board the following account of the success which has attended the efforts of a Cornish small holder in the direction of pork production, and which has resulted from his untiring energy and his policy of breeding a thrifty type of pig and securing cheap food for the animals.

The Small Holder.—The small holder in question began as a farm labourer, then did some regrating, and next hired a field and gradually stocked it. At the time he took over the small holding his stock comprised a cob, two cows and two brood sows; and he was then working for four days a week as farm labourer and two days as a regrater. When the small holding was taken the tenant was 46 and his son 19; he has had no woman help. The tenant is very handy at all kinds of farm work.

The Small Holding.—The small holding is 30 acres in extent and is very badly situated, being reached by two roads, one very narrow, and the other a mere cart track. Plymouth is fifteen miles away.

The land is hilly and very poor; there is no really good land on the holding. In 1909, when taken over, one-quarter was overrun with furze and bracken, another portion had been used for mining purposes and was unfit for cultivation, and only about one-half was of agricultural value.

There were two small buildings without roofs or doors; the agent, however, agreed to provide timber and galvanised iron for any buildings the tenant might choose to erect. The yearly rent for the holding was £14 5s.; the tenant had full liberty to cultivate the land as he pleased.

On taking the holding the tenant first erected cheap, iron-covered houses for the animals, which were removed from his field to the holding during the first year of tenancy. Then the tenant and his son erected for themselves a one-storey building, 45 ft. by 23 ft. by 10 ft. high, out of stone (which is plentiful in the district) and with cement floors. The building consists of a good-sized living room, two bed rooms, scullery, dairy and larder; it is well lighted, and lined and ceiled throughout with varnished match-boarding.

Crops and Stock.—During the seven years of occupation the tenant, in addition to other work, brought 6 acres of the furze and bracken land into cultivation. In 1916 4 acres of oats, ¾ acre of mangolds and cabbages, and ½ acre of potatoes were grown, all being heavy crops.

The head of *cattle* during that year comprised 3 cows, 4 yearlings and 1 calf; of *horses* a useful cob, a two-year-old, and a yearling colt; of *poultry* 70 fowls and 3 geese; and 87 *pigs*.

The Production of Pork.—The pigs are of the Large Black breed, and the sire of most of them was a magnificent boar.

The successful pork production has been in no small degree due to the thrifty class of pig thus secured.

Besides the boar there were on the holding 5 brood sows, 7 fattening pigs of 10 score lb. each, 5 fattening pigs, 2 about 100 lb. each, 24 young pigs worth about 45*s.* each, 28 large farrows worth 20*s.* each, and 17 young farrows, three weeks old. The total value of the pigs was estimated at £200.

The practice is to sell the pigs as baconers at about 11 or 12 score lb. each, one at a time, at Plymouth. The tenant buys small quantities of eggs and butter from his neighbours and markets them at Plymouth weekly. This helps his pork production work in two ways :—

(1) *Being a regular attendant at Plymouth market, he* is able to obtain the best market price for his pigs, selling them in advance and avoiding losses from bad markets.

(2) On his weekly visits he is accustomed to bring back from 2 to 4 cwt. of waste from the bakeries. This bakery waste consists of portions of dough, stale bread and cakes, and the scraped-off outsides of loaves damaged in baking.

In addition to the cheap feeding material thus obtained, grass and roots on the holding are available for feeding and are supplemented by middlings, barley meal, and a pig meal sold locally containing 4·25 per cent. of oil and 14 per cent. of albuminoids.

In the thirteen months, January, 1916, to January, 1917, the total weight of pigs sold at Plymouth as baconers was 6,764 lb. Further, a truck load of 15 pigs of about 12 score lb. each, and of a total weight of 3,327 lb., were sold at Calne, the cash return being £155 2*s.* 10*d.* There was thus a total weight of 10,091 lb. of pigs sold off this holding in 13 months.

EXPERIMENTS IN BROODING CHICKS.

W. G. TARBET.

FOLLOWING upon the lines of a late American practice in the use of anthracite hovers for the brooding of chicks, the writer made many experiments during the spring, summer and winter of 1916 to determine what would be a suitable outfit for the average British utility poultry-farmer.

The giant hover, obtained from the United States, was stated to be of a capacity of 1,590 chicks. To operate it

economically it was essential that at least 1,000 chicks should be brooded under it. However practical it may be on a very large farm in America to be able to hatch out 1,000 chicks within a couple of days of one another, the writer came to the conclusion that in this country at least a practical outfit would necessarily be limited to hatching 200 chicks. It is obvious that to hatch 1,000 chicks at one time, 2,000 eggs must be used. As the practice is to try to incubate every egg when not more than four days old, an output from the breeding pen of 500 per day would be required, and, taking the average production of the hens as one egg every second day, 1,000 breeding hens would be needed. An alternative means of supply would be to purchase sufficient eggs or day-old chicks to make up the 1,000 required.

Another objection to the giant hover in question was the very flimsy nature of its construction. Both stove and drum were of very light iron sheeting, not at all calculated to give a long life even under the best of conditions. The most interesting point about this American stove was the elaborate system of heat regulation. A metal thermostat is used in some of the hovers, in others a capsule of the usual type but of very large size. The instrument is placed some 6 in. from the floor and connected with a lever actuating a damper which opens or shuts according to the impulse given by the capsule or thermostat. Altogether it was sufficiently clear that a hover of this nature was too bulky, too elaborate, and of too short a life (under farm conditions) to provide what the writer wanted, namely, a smaller outfit, of a very simple nature, capable of being easily shifted from house to house, sufficiently well made to last for twenty years or more (in order to compensate for the preliminary expense), and with the parts for replacing the fire-bars easily obtainable at moderate charges.

These requirements, even if no other reason presented itself, indicated a British stove manufacturer. It is needless to describe the details of experiments made with different stoves, and the difficulties raised by most makers regarding any alterations. Suffice it to say that at last a suitable stove was found and tried.*

The stoves at present in use are of cast iron, consisting of a base and bottom in which is located the shaker (that is a

* The writer will be glad to supply, on request, the name of a small firm in London who have arranged to supply single stoves. The price of the stove and a 6-ft. length of iron chimney is £4 10s., carriage forward.

circular casting of fire-bars which can be rapidly swung to and fro in order to get rid of the ash, but which can also be tilted in order to dump the grate contents when cleaning out is required). Upon this another circular and separate casting is placed, followed by a top casting which contains the socket for the chimney, as well as a door for filling and for regulating the draught. The casting at the base is also provided with a sliding door for regulating the intake of air. The whole stove is of heavy castings, well made and fitted, and should last for very many years. The system of separate castings is very convenient, as the stove can be moved about from one house to another in small sections. The system also allows the possible addition between the two upper castings of a large drum for circulating heat should any user find this necessary.

The apex house* in which these stoves are used is of the type described in the issue of this *Journal* for December, 1916, p. 869, with the exception that a glass door takes the place of the wire door. No attempt was made to make the house air-tight, the air coming freely between the weather-boards, but being deflected upwards. In practice the house is sprayed, and several barrow-loads of earth are shovelled in. (If the place is infested with rats, 1-in. wire netting should first be stretched along the bottom.) The stove is then placed in the centre, and the smoke-pipe projects through the roof about 18 in., a cap being placed on the top to prevent down draughts. In order to dry out the soil the stove is lit about two days (or, if the soil is very damp, three or four days) before the chicks are to be placed in the house. On the top of the dried soil is next spread a barrow-load of sand, since day-old chicks scratch better in that than in the soil itself. They also eat very much larger quantities of this sand than they would of grit.

The temperature of the house is kept at about 80° F. (thermometer 3 ft. away from the stove and on the ground) for the first few days.†

The stove is made sufficiently warm to keep the chicks well away from it. At night the 200 chicks should be lying in a wide ring about 18 in. or 2 ft. from the base. During the day the stove is allowed to provide just a nice temperature, and the chicks are never still from dawn to dark with the exception of a brief interval when some of them will run right up to the stove, quickly heat themselves and be off again.

* Measuring 9 ft. by 8 ft., and 7½ ft. high.

† As a matter of fact no thermometer is at present used, the chicks themselves providing sufficient indication as to correctness of temperature.

The stove is filled at about 8 p.m., and again at 6 a.m., these hours being the most convenient. It receives two shakes or so during the day when chicks are being fed. The ashes are raked out once a day and left to cool on the floor, the chicks being extremely fond of hard coal-ashes. No litter of any sort is used, the chicks sleeping on the bare earth. Four times a day a good grade of chick food is roughly raked in according to the age of the chick. A savoy cabbage is cut into two and given each evening, even to day-old chicks! Water is supplied once a day and kept as far from the stove as possible. The stove is cleaned out once a fortnight, although the need for cleaning depends upon the grade of anthracite used. With really good coal cleaning out should not often be required. With bad anthracite it is well to watch for stones, slate, etc., which take up too much space in the stove and make it difficult to keep a good heat.

A rough-and-ready system such as this, if successful, will go far to make the brooding of chicks less troublesome than in the past, and less of a terror to the poultryman. The work of the latter becomes vastly more agreeable than filling and lighting lamps and attending to chicks in outdoor brooders in all weathers. The stove-heated houses, being also very freely ventilated, are not unpleasant on cold, winter days, while, as there are no troublesome little niceties to attend to, the system is well adapted to unskilled labour.

As regards the success of the system, the trial has not been of such long duration as to permit of dogmatic statements; but as a proof of the writer's convictions, it may be said that his present intention is to keep to this system in future. During the very severe weather in January, 1917, three hatches were placed in three of these houses and the results were very satisfactory indeed. From the first day the chicks seemed to forge ahead, feathering was very rapid, and the mortality was under 5 per cent., a very good result, considering that no particular care was taken to select the chicks after the hatch, and that in one case day-old chicks were put in the same house along with week-old chicks.

The question of expenditure next has to be faced. While any house will do, it is advisable that plenty of light should be available. The apex house, with 72 sq. ft. of floor space, and 7½ ft. of head room, cost about £3 to build before the War. With the stove and chimney and the brooding outfit for 200 chicks, the cost comes to £7 10*s*., or 9*d*. per chick. A foster-mother

for 50 chicks costs from £2 to £4 10s.—a wide range of prices due to the inferiority of certain makes. A safe average might be taken at £3. For 200 chicks, therefore, the foster-mothers would cost £12. As regards the life of the respective outfits, there can be no question that the stove and apex house will outlast any foster-mother yet made, and that the cost of upkeep will be less.

The cost of fuel may appear to be high, but even in the severest weather does not exceed 3*d.* per chick for eight weeks. How this compares with paraffin used in outdoor brooders cannot be stated, but the paraffin is likely to be cheaper. The compensating advantage, however, is the saving in labour and the more agreeable conditions under which the work can be done.

So far as the health of the chicks is concerned the writer is confident that the fact of their being always on the ground is a feature of the system that will be recognised as of material advantage by all experienced chick-rearers. No matter what the weather is like, the chicks apparently suffer no injury from being confined to the house. The soil being dry gives ample opportunity for plenty of scratching, while it also renders the droppings innocuous.

It is proposed to work this system by placing the houses in a row. The chicks will be kept in them for about four weeks or more with a very small run at the side of each house only. The cockerels will then be removed and the pullets of two houses transferred to a similar house with a similar stove, on free range.

Broad perches will be placed round the stove to induce early perching, and as soon as this is accomplished and the weather is safe the stove will be removed. If any huddling is observed an ordinary paraffin heater will be used to check it. Once, however, a chick has taken to the perch it is seldom that any trouble from huddling arises. The facility the system gives for the placing of perches is one of its merits.

Further experiments are being tried to ascertain what effect deflectors surrounding the stove would have as regards saving of fuel. It is believed, however, that the freer the air the better it will be for the chicks, and that it is preferable to spend money on fuel rather than on more elaborate plant. It is possible that the heating-drum placed between the upper and middle castings would have a very marked effect upon the heat given out by the stove. With the present price of

materials, however, this drum would add considerably to the cost of the outfit, and it is probable that until the War is over only two or three experimental ones will be made.

It is pleasant to feel that, granted the stove has been tended properly, the chicks will be as lively to-morrow as they are to-day, no matter how severe the weather. With 30 of these houses in a row one man will readily be able to attend to 6,000 chicks and also manage to keep going the others upon the range.

Whether cabbage is a suitable food for small chicks or not appears to be a very debatable point. It is unfortunate that the two experiments of feeding cabbage and stove-brooding have had to run alongside one another, so that no check on the former exists. So far the writer can see no ill effects, and certainly the chicks are very fond of the white heart of the savoys used. Even day-old chicks manage to scramble up on it and pick at the tenderest morsels. Should this cabbage experiment prove satisfactory it will help very materially in reducing the trouble of obtaining green food for chicks in early hatching.

Any reader desirous of making a trial of the system will be given an opportunity of seeing it at work, on application to the writer through the Editor of this *Journal.*

Poultry-Keeping on a Small Scale.

THE following Note has been communicated to the Board by Mr. G. D. Tripp :—Even in cases where only a small space in a backyard or small garden is available for laying-hens, a great deal may be done towards maintaining the egg supply of a small family. The essential requirements are :—

(1) A dry, watertight open-fronted house, well ventilated, but free from draughts, and situated so as to get the maximum of sunshine ; and

(2) Some White Leghorn pullets of good-laying strain, that have been reared on free range. Failing White Leghorns, pullets of any *active* breed may be used ; many first-crosses, too, will give good results.

If these essentials can be provided, the following details should receive attention :—

The fronts of the house should be boarded up to 18 in. from the ground, and provision made, by movable shutters or other

means, *to prevent rain from beating into* the house through the open front. A dropping-board should be provided, about 2 ft. from the ground and 6 in. below the perch.

The floor of the house should be bedded about 6 in. deep with any kind of loose litter, dust, chopped dry bracken, cut straw, etc.

A water vessel and a box for holding grit, oyster shell and charcoal should be hung on the wall of the house well above the litter.

The best results will be obtained by buying April-hatched pullets in September if the White Leghorn or any light breed is chosen, or March-hatched pullets if a heavy breed is selected.

These pullets should begin laying in October and should be profitable until the early autumn following, when they should be disposed of. The house should then be thoroughly cleaned and disinfected before the next batch of pullets is installed

For the best method of feeding, see Leaflet No. 114 (*Feeding of Poultry*), and Special Leaflet No. 2 (*Notes on Poultry Feeding*).

When birds are kept in this way it must always be remembered that, unless they are carefully looked after, they will lack three essentials for egg production which are obtained naturally by birds on free range: (i.) exercise, (ii.) unlimited green food, (iii.) insect and other animal food.

Exercise can be ensured by making the birds scratch for their grain food by burying it well in the litter.

Plenty of green food must be provided. Sufficient animal food should in many cases be provided by the use of household scraps; where these are insufficient, meat meal or fish meal can be used.

Another essential to success is absolute cleanliness; the dropping-board should be cleaned daily and sprinkled with dry earth, and fresh litter should be provided when necessary.

A properly-kept house should be quite free from bad odours, and thus be unobjectionable from the point of view of the local sanitary authority.

Six pullets (no cockerel is needed) kept under these conditions may reasonably be expected to lay about 900 eggs in the time mentioned. A house 6 ft. wide and 8 ft. deep will provide ample space.

THE WORK OF THE WOMEN'S LEGION IN RUTLAND.

THOMAS HACKING, M.Sc.,
Agricultural Organiser for Leicestershire and Rutland.

THE excellent work done by the Women's Legion in various parts of Rutland has often been the subject of appreciative comment, and the work so far accomplished is in no wise behind that done in other counties. The Countess of Gainsborough is the President of the Rutland Branch of the Legion, and the success has been entirely due to the untiring energy and zeal of the women who compose the committees and the commandants of their respective sections.

The object of the Legion is to provide a capable and efficient body of women whose services can be offered to the State, as may be required, to take the place of men needed in the firing-line, or in other capacities.

The organisation is entirely non-political and without class distinctions or religious restrictions.

The following particulars regarding the organisation are taken from the circular which has been widely distributed throughout the county.

The Rutland Branch comprises the following Sections:—

(1.) GENERAL.—For honorary members and voluntary workers.—To render voluntary assistance for any object; and generally to act as directed by the President, in forwarding the work of the Legion.

This Section is designed for women who, being unable to devote their whole time to the work of the Legion, desire to give such help as they can to assist National needs.

> NOTE.—Those in the district desirous of doing work as cooks in military camps, or in munition canteens, should apply to the Hon. Secretary, who will forward their names and addresses to Headquarters in London.

(2.) AGRICULTURAL SECTION.—To appeal on National grounds to women to render assistance to farmers who are in want of labour during the harvest and other periods of seasonal stress.

To urge women to take the place of farm workers called to the Colours, and to induce farmers to employ such women at a fair wage.

To form committees of women in the county willing to render voluntary or other assistance, by giving facilities to

enable suitable women to be trained for dairy, poultry, and agricultural work.

(3.) HORTICULTURAL SECTION.—To appeal on National grounds to members to grow herbs for medicinal purposes and revive the herb industry in this county.*

(It is not intended that cottagers should grow herbs in place of vegetables; the appeal is only to those who have gardens large enough to do so, and where the soil is suitable.)

To induce the country people to take up gardening and cultivate vegetables wherever possible, and to encourage them and the school children to collect the wild herbs.

To promote the fruit-bottling industry and jam making in the fruit-growing districts, and to assist fruit farmers by providing labour for picking, or in such other ways as the County Committee may advise.

To form a committee of women who will organise the county and issue all the necessary instructions and literature.

AGRICULTURAL SECTION.—The object of these brief notes is to give a general account of the work done by the Agricultural Section. The officials responsible for this Section are as follows:—

Chairman: The Marchioness of Londonderry, Oakham.
Commandant: Miss Brocklebank, Wing Grange, Oakham.
Hon. Sec.: Mrs. Molesworth, The Drill Hall, Oakham.

The active work of the Section owes its inception to the public-spirited action of the Marchioness of Londonderry, supported by Miss Brocklebank, Commandant, and Mrs. Molesworth, Honorary Secretary of the Section.

It has been one of the special duties of this Section to enrol volunteers for agricultural work. Each village in the county has been canvassed, and women have been asked to assist farmers wherever possible, and in the reports to hand from the village registrars the results are as follows:—

Of 473 workers in Rutland, 324 are War workers, of whom 89 have been regular workers and 235 occasional only. The preponderance of occasional workers is mainly due to the fact that they have their homes to look after as well as the land work. Of these War workers, 59 are members of the Legion, 172 are registered, and 172 wear the Board of Agriculture armlet.

* See note on Medicinal Plants in this *Journal* for February, p. 1103.

Of the 155 employers, 129 have reported themselves to the superintendents as satisfied or very satisfied. Only 2 were actually dissatisfied, though a good many consider that female labour is expensive; one farmer expressed the opinion that three women were equal to two men.

In many villages there are several women who have expressed their willingness to work, but who have not been called upon to do so for two reasons: firstly, there has been no shortage of labour, owing to there having been very little arable land; and, secondly, it has not been possible to make use of these offers of assistance by sending the women to other villages because they are unable to leave their homes for any length of time.

The Superintendent of Great Casterton remarks: "One objection to the casual employment of women has been raised. This is the matter of Insurance cards. The greater part of the year these women are not doing paid work, so that unless the women stamp the cards themselves, which would mean a considerable outlay, they must lose the entire benefits of the Insurance." In this district they are evidently not aware that casual women workers need not stamp their cards if they apply for exemption.

The following work has been done by Rutland women: milking, dairy work, care of poultry and calves, shepherding, washing sheep; ploughing, sowing, planting potatoes, hoeing wheat and turnips, weeding of docks, thistles, and other weeds; stacking, threshing; haymaking, driving mower; gardening, raking leaves; fruit-picking; and carting.

The work of the Legion has been very successful indeed, and will compare very favourably with that done in other counties.

MOTOR TRACTORS.—The women responsible for the Agricultural Section of the Legion have shown themselves fully alive to the needs of the moment; they realised that difficult times were coming; they knew that, owing to the shortage of labour, farmers would soon find themselves in a very difficult position with regard to the cultivation of their land; they realised that farmers would require practical help, and the Section laid itself out to supply this help. They set to work and privately raised the necessary capital for the purchase of tractors, cultivators and ploughs, and two motor-tractors have been constantly at work under the daily supervision and management of Miss Brocklebank, the Commandant.

The tractors employed are the Mogul 25 h.p. The first tractor purchased has been constantly employed since the 20th of June last in cultivating fallows and stubbles, and in ploughing land for wheat. The tractors start on petrol and run on paraffin; each tractor weighs 4½ tons, and has a ploughing speed of 2 miles per hour, with three speeds (two forward and one reverse).

In ploughing, the tractor draws one of Ransome's 4-furrow special tractor-ploughs, and when cultivating draws a 13-tine Ransome cultivator of the "Orwell" pattern, taking a width of about 8 ft. at one stroke.

The charges for cultivating and ploughing are as follows:—

Ploughing	16*s*. per acre (inclusive).		
Cultivating twice	21*s*.	,,	,,
,, once	11*s*.	,,	,,
,, ,, after ploughing ..	10*s*.	,,	,,

2*s*. 6*d*. extra per acre is charged on heavy land.

The charges may seem somewhat high, when compared with those made by the owners of steam tackle for similar work, but it should be remembered that in the case of the tractor the farmer does not provide coal, nor cart water, both of which usually prove to be expensive items. It is also important to note that there is no attempt to make a profit on the work, and the above charges may have to be revised in accordance with the price of oil.

It is gratifying to know that farmers are making extensive use of the tractors, which are doing excellent work on both heavy and light soils; under favourable conditions it has been found that 5 acres a day can be ploughed, while an average day's work in cultivating is about 6 acres, though this average cannot be kept up owing to occasional stoppages, heavy land, and small and hilly fields.

The tractors have undoubtedly been a great boon to the farmers of Rutland, and have in no small measure helped to meet the difficulties which have arisen there owing to the shortage of labour.

Owing to the pressure of work, it has been found quite impossible to carry out anything in the nature of exact engine trials.

CO-OPERATIVE IMPLEMENT SOCIETIES.—Particulars of the leading makes of motor-tractors have already been given in this *Journal*.* It has been suggested that tractors are too expensive for ordinary farmers, but this difficulty could

* November, 1915, p. 760.

Women at Work: Shocking Barley.

Tractor and Plough at Work.

be overcome by the formation of co-operative implement societies, and there is no reason why such a society should not be formed to meet this particular objection.

The share capital could be raised by employing the methods adopted by the successful Irish societies.

At a meeting of the Women's Legion, Lord Crawford urged the necessity of an extension of the Legion's work, and appreciative references were made to the successful work already accomplished.

The Rutland Branch has carried on work of great value throughout, and has undoubtedly done much to meet the difficulties which have beset agriculture during the last two years, and it may be safely asserted that the work will be extended wherever possible. The writer is indebted to Miss Brocklebank and Mrs. Molesworth for valuable information supplied.

Successful Employment of Women on Farms.

THE following instances of the successful employment of women on farms have been communicated to the Board by Mr. J. O. Peet, B.Sc., Inspector, Board of Education :—

(1) On a farm in Buckinghamshire three women have been employed, one from the early winter of 1915–16, and two from the early spring. Two came from London where they worked, one as a teacher and the other as a clerk ; the third was accustomed to country life, but not to farm work. The town women had a little training before they came to the farm. Their main work has been milking, cleaning cow-houses and attending cows, but they have also done some field work such as hoeing. They milk about ten cows each at a milking. The employer states that at cleaning utensils, cowsheds, etc., they are probably better than men, that they have been most useful, and that he could not have carried on without them. Another farmer in the county reports that the girl he now employs mainly for milking and doing a retail milk round with a pony and float is more satisfactory than a man.

(2) A Berkshire farmer has employed two women of the educated type for about eight months. They were both from London and had a little training before coming to the farm. Their main work is milking, attending to cows, calves and pigs, and doing a retail round in the town with milk-floats, but they have also helped with all kinds of farm work, including work with horses. The employer states that at milking and cleaning up they do very well, and at the milk

round they are especially good. He does not know how he could have carried on without them, though there are many jobs they cannot do. Two other farmers on neighbouring farms in the same county have employed women from the outbreak of war, and, as a consequence, had all the labour they required during last season, though they have not a man eligible for military service. Local women have been employed for general field work, and imported women mainly for milking and other work with live stock.

(3) A Hampshire farmer has employed two girls of the educated type, one for twelve months and the other for five. The former had a little training before she was engaged, but the other had none. Their main work has been with the cows and doing a round with milk-floats in the neighbouring town. The employer is well pleased with their work; he stated that they took an interest in it, were very dependable in work they understood, and that he had no wish to employ men in their places while women were available.

(4) A girl of 18 years of age, of superior domestic servant type, employed on a farm in Hertfordshire, was milking ten cows at each milking after only nine weeks' experience.

In all cases known to the writer employers have reported most favourably on women's work when this has consisted mainly of milking and working a retail milk round. At this work women appear to be most successful. Wherever milking has been an important part of their work most of them have acquired speed in a reasonable time, working up to four or five cows at a milking in a month, and to nine or ten cows in eight or nine weeks. Where milking has been of less importance they have usually developed speed much more slowly, as was, perhaps, to be expected. The problem of dealing with the mating and calving of cows when both male and female workers are employed is said to have deterred some farmers from employing women for work with dairy cows, but little or no difficulty is experienced in actual practice. The cows are merely removed to a loose box or yard and their condition reported to the head cowman or the farmer, who then attends to them.

In regard to milking a custom prevails in some parts of the country, notably in Wiltshire, which could well be usefully extended at the present time. Labourers' wives are employed simply for milking, for which they attend twice a day. The arrangement permits women whose domestic duties do not allow them to be absent from home for more than a short

period at a time to do useful work of great importance from the national point of view, and at the same time to add materially to their weekly incomes.

(5) On a Lincolnshire farm two women, previously accustomed to farm work but not to horses, were each put last spring to work with a team. In a few days they acquired skill with the plough, sufficient at any rate for straightforward work, and, as there were several other teams on the farm, the skilled work of setting ridges, taking up the last few furrows, etc., could be done by the men. A change in the system of managing the horses was introduced on the farm which helped to simplify the employment of women. A horsekeeper was appointed to live on the farm and attend entirely to the horses indoors. The day's work for the horsemen and horsewomen commenced with harnessing the horses in the morning and ended with unharnessing them at night. On another farm in the same district the farmer's wife and one of her friends took an important part in the ploughing and other cultivations last spring.

(6) Two women of the educated type, together with a number of local women, have been employed on a large Wiltshire farm. The imported women have been used mainly for work with horses, such as cultivating, harrowing, rolling, etc., but they have done little or no ploughing and no heavy carting. The farmer speaks in high terms of the women's work.

(7) The following experience on a farm in the Midlands shows what may be done with a little trouble and determination, in the way of substituting women and of maintaining production in spite of labour difficulties. The farm is situated near a town and is devoted to suburban farming. There is a herd of 50 dairy cows which are milked by machine, and potato and other market-garden crops are extensively grown. Women have always been employed for potato-planting and for pea, bean and potato picking. In the winter of 1915–16, when male labour became very scarce, four young women were secured from the town as permanent workers; later, the number was increased to nine. Two of these left but were replaced. Of the nine women now employed all have been on the farm throughout the summer and some of them for a portion of the winter of 1915–16. With the exception of one domestic servant the whole of the women had previously been employed in factories, and none of them had any previous experience or training in farm work. The working day is 8½ hours, and their work has consisted of

feeding cows, cleaning cowhouses, most kinds of field work, horse-hoeing, and various other kinds of horse work, including a little ploughing. The employer reports that they are very keen about their work and are much interested in it, are very reliable at any work they understand, and are very much better than any male labour one could expect to get now; his staff now consists of three times as many women as men, and without the women his work could not have been carried on.

The Use of Bracken Roots and Fronds.

THE attention of the Board has been called to the possible use of bracken "roots" (rhizomes) as a food for pigs. A recent analysis of bracken root which the Government Laboratory has carried out for the Board, shows that nearly two-thirds of the "root" consists of carbohydrates of which about one-half is starch. The following were the figures:—

		Per cent.
Moisture		12·4
Oil (ether extract)		1·6
Albuminoids		4·8
Carbohydrates		63·4
Of which starch	30·5 per cent.	
And sugar	0·7 "	
Crude fibre		12·8
Ash		5·0
Of which sand	0·8 per cent.	
		100·0

Use for Human Food.—The use of bracken roots as human food has been recorded by many observers. Thus "in some parts of Europe and Northern Countries" the underground stems "are prepared by washing and pounding, and are mixed with meal to make bread in times of scarcity."(1)

"The people of Normandy have sometimes been compelled to subsist on bread made of brake-roots. A variety of brake, by some considered to belong to this species, but generally separated under the name of *Pteris esculenta*, furnished the New Zealanders with the chief portion of their sustenance before the settlement of their island by the English. The writer can bear testimony to the nutritive qualities of the rhizomes of our native brake, having frequently eaten them in considerable quantities. They should first be roasted over a fire until the outer skin is charred, and then the fibres separated by beating; the starchy substance that remains tastes much like oat cake, but with a slight astringency that is not unpleasant. Few substances will keep off hunger

during violent exertion better than the underground stem of the brake thus prepared, a fact worth remembering by the rambler in uninhabited districts."(2)

"In time of dearth bracken root has sometimes, when dried and ground and mixed with rye flour, been used to make a coarse bread."(3)

"We have an enormous supply, almost an unlimited supply of starch in the underground stems or rhizomes of the common bracken-fern. Starch from this source is used as food in many parts of the world. Thirty years ago I remember eating bread or cakes prepared from it in the Canary Islands. A closely allied species of fern, hardly to be distinguished from *Pteris aquilina* is the Australian *Pteris esculenta*. It is, as its specific name implies, used as food, and it is a well-known fact that the Maoris of New Zealand—a very fine race—nourish themselves on starch from a similar source."(4)

"In the East Indies and Polynesia the rhizomes of a number of ferns are eaten as starchy foods or the starch is extracted from them."(5)

Bracken roots would affect the food supply indirectly if fed to pigs, or if it were possible to obtain from them the starch required for industrial purposes and which is at present obtained from foodstuffs, *i.e.*, rice and potatoes.

Use for Pig Feeding.—What is food for man may safely be treated as fodder for pigs. Probably the least troublesome method would be to turn the pigs, unringed, among the bracken, and leave them to root out the rhizomes.

A correspondent at Brightling has informed the Board that he fed his pigs for three weeks on bracken roots, sold at Battle, with good results; the roots were used chiefly as a midday meal.

The Prussian Ministry of Agriculture has called attention to the value of the roots as a substitute for potatoes for pigs. In investigations at the Agri-Botanical Institute at Königsberg, sucking-pigs and young pigs of 55–66 lb., after being accustomed to the food, were fed 2¾ lb. per head per day without harmful results, and tests with fattening pigs were being carried out, but were not concluded. The Ministry stated that the roots may be gathered until the end of April, after which their feeding value diminishes*; one man can be put to work, turning over the ground, while a child picks out the roots, which are then washed and fed without being chopped or otherwise prepared.(6)

* Dr. A. E. Shipley states that the rhizome contains most starch in the early spring.

"The meal to be got by passing the dried 'roots' through a sausage machine . . . . might replace the 'sharps' in the soft food of pigs. W. Colenso, writing on the food of the Maoris, tells us that pigs fed on the underground stems of the *Pteris* always yielded the finest and most delicious pork." (4)

Use of Fronds.—In considering whether it would be an economic proceeding to uproot the rhizome for human or animal food, or for industrial starch, it must be remembered (1) that where the bracken has encroached on arable land, pasture, or heather, its eradication would increase the arable crops, the sheep feed, or the breeding of grouse; (2) that the fronds have value as a vegetable, and as an animal food, and the mature "fern" can set free straw for feeding by taking its place as litter.

As a Vegetable.—"The young fronds of the bracken, cooked and served like asparagus, make an excellent green vegetable course."(4)

"In southern climates the young shoots are often sold in bundles as a salad."(7)

As an Animal Food.—"The young tops of the plant are boiled in Hampshire for hog's food, and the peculiar flavour of Hampshire bacon has been attributed to this custom."(7)

As a result of a German investigation, the Prussian Ministry of Agriculture recommends the young fronds as a good supplementary food for pigs. Farmers are advised to steam a mixture of the fronds with a few potatoes and a little water and then cut them up small. It is stated that for this purpose only such fronds can be used as are rolled up and not yet unfolded, and which easily break off smooth at a height of 16 in. to 20 in.; older fronds are not suited to pig feeding.(8)

"The hardiest and healthiest specimens (of Herdwick sheep) are found on the fells, where the pasture is of the scantiest and poorest description, growing much fern, which, in spring, is eaten to some extent in the early, tender, rolled-up stage." (9)

As Litter.—The value of bracken as litter, where straw is scarce, or where straw can be profitably fed to stock, has already formed the subject of a special leaflet (No. 38) of the Board. The following is taken from the leaflet:—

"Bracken harvested while still green usually contains as much phosphoric acid as straw, and much more nitrogen, but less potash. If exposed to rain throughout the winter a considerable loss of substance is likely to result, although

bracken cut in April has been found, on analysis, to have a similar composition to straw.

"Bracken possesses a considerable power of absorbing ammonia and urine. To secure the full absorptive effect, however, bracken must be very thoroughly trampled upon by stock.

"Dung made from bracken may be expected to be equal in chemical composition to dung made from straw. On the other hand, it takes longer to decompose in the soil, the fibrous woody stem being only slowly attacked. It therefore opens up the soil more, and is for that reason likely to be more useful on a heavy clay than on a light, sandy soil. Bracken should be cut and dried in autumn, but where this is impracticable it may be cut and carted during suitable weather throughout the winter months."

REFERENCES:

(1) *Dictionary of Economic Plants*, John Smith, 1882, p. 59.

(2) *The Useful Plants of Great Britain*, Johnson and Sowerby, p. 293.

(3) *Les Plantes Médicinales et Usuelles*, H. Rodin, p. 399.

(4) *New Source of Food, Starch from Bracken*, Dr. A. E. Shipley in "The Times," 19th February and 15th March, 1917.

(5) *The National Standard Dispensatory*. Article on Ferns.

(6) *Wiener Landwirtschaftliche Zeitung*, 22nd April, 1916.

(7) *Herbal Simples*, W. T. Fernie.

(8) *Deutscher Reichsanzeiger*, 16th May, 1916.

(9) *Farm Live Stock of Great Britain*, Robt. Wallace, p. 557.

Notes on Feeding Stuffs in March: *From the Animal Nutrition Institute, Cambridge University.*

No considerable changes in price have occurred during the month. A few feeding stuffs are appreciably cheaper, notably wheat offals, while a few are rather dearer.

In last month's notes attention was drawn to the increasing scarcity of imported feeding stuffs, and farmers were exhorted to cut down their consumption of all kinds of concentrated feeding stuffs to the lowest possible minimum. There is no reason to modify this advice. Indeed, everything points to the necessity of emphasising it. There is no doubt that for the next year at least live stock will have to subsist on very much smaller rations of concentrated food than they have customarily been allowed.

Under the present conditions it is necessary to discriminate between the different classes of stock in respect of their value to the nation. In the first place, horses engaged in useful work, such as farm work, railway work, and other work of

national importance, must get their usual ration of concentrated food. Other horses, *e.g.*, those used for carriages and other forms of pleasure, should be turned out to grass. It is possible that much horse corn might be saved by some system of organising delivery of goods by tradesmen's carts.

After the working horses, the most important stock are the milking cows, which are important for two reasons: (1) their milk is necessary for the health of large sections of the community, and (2) they are economical converters of fodder into human food. A good cow in full milk will produce 1 lb. of dry human food from 7 to 8 lb. of dry fodder. In summer,

TABLE I.

Feeding Stuff.	Digestible Food Units.	Approximate Prices per ton at the end of February.					
		London.	Liverpool.	Hull.	Bristol.	Glasgow.	Leith.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soya Bean Cake	122·3	17 15 0	—	—		—	—
Decorticated Cotton Cake ...	126·3	—	18 0 0	—	18 0 0	18 10 0	19 0 0
Decorticated Cotton Meal ...	126·3	17 15 0	—	—	—	—	—
American Linseed Cake ...	119·0	18 3 9	—	—	—	—	—
Indian Linseed Cake	123·1	—	18 0 0	—	—	18 15 0	19 0 0
Russian Linseed Cake ...	123·5	—	—	—	—	—	—
English Linseed Cake... ...	120·1	19 15 0	19 10 0	19 0 0	20 5 0	19 10 0	19 5 0
Bombay Cotton Cake	65·3	14 17 6	15 5 0	14 12 6	—	—	15 15 0
Egyptian Cotton Cake ...	71·9	15 15 0	15 15 0	15 10 0	15 15 0	16 5 0	16 5 0
Coconut Cake	102·6	16 10 0	—	—	17 0 0	—	—
Palm Kernel Cake	96·1	16 0 0	14 15 0	—	15 15 0	16 5 0	16 10 0
Palm Kernel Meal (extracted)	92·5	15 10 0	—	—	—	—	—
Ground-nut Cake	145·2	Nominal	—	16 15 0	—	18 0 0	—
English Beans	99·5	17 13 8	19 2 8	17 1 0	16 16 10	—	—
Bean Meal	99·5	—	—	—	—	18 15 0	—
Chinese Beans	101·2	—	17 19 4	—	—	—	—
English Maple Peas	97·2	19 11 1	—	18 17 9	—	—	—
English Dun Peas	97·2	17 15 7	—	17 15 7	—	—	—
Calcutta White Peas	97·5	Nominal	—	—	—	—	—
American Maize	93·8	15 17 4	15 5 3	—	—	17 5 0	16 17 6
Argentine Maize	94·2	16 16 0	16 2 0	16 16 0	16 6 8		
Maize Meal	86·5	18 0 0	16 15 0	17 12 6	17 0 0	17 10 0	17 12 6
Maize Gluten Feed	121·6	16 10 0	16 12 6	—	16 10 0	—	—
Maize Germ Meal	99·2	16 16 0	16 15 0	16 10 0	17 0 0	—	—
English Feeding Barley ...	83·0	18 4 0	—	18 9 7	18 4 0	—	—
English Oats	75·4	18 0 0	17 8 5	17 6 8	17 16 8	17 0 0	16 10 0
Argentine Oats	75·4	18 8 5	—	—	—		
Malt Culms	69·9	12 10 0	13 10 0	11 10 0	11 15 0	12 10 0	13 10 0
Brewers' Grains (dried) ...	84·5	14 10 0	—	14 10 0	14 7 6	13 12 6	14 5 0
Brewers' Grains (wet) ...	21·1	2 8 0	—	1 15 0	—	—	1 15 0
Distillers' Grains (English)...	101·2	15 2 6	14 0 0	—	15 0 0	13 15 0	14 10 0
Distillers' Grains (French ...	101·2	15 0 0	—	—	—		
Distillery Mixed Grains (wet)	20·0	—	—	—	—	—	2 0 0
Egyptian Rice Meal	78·7	Nominal	—	—	—	16 10 0	—
Burmese Rice Meal	78·7	Nominal	15 15 0	—	—		
Rice Bran	78·7	16 0 0	—	—	—	—	—
Wheat Middlings (coarse) ...	94·8	13 15 0	—	14 5 0	—	16 15 0	15 10 0
Wheat Sharps	90·5	14 15 0	14 17 6	14 10 0	14 10 0	14 10 0	14 10 0
Wheat Pollards...	96·7	—	13 17 6	—	—	—	—
Wheat Bran	*77·5*	*13 15 0*	*15 5 0*	*14 10 0*	*14 15 0*	*15 0 0*	*14 0 0*
Wheat Bran (broad)	79·9	14 15 0	—	16 10 0	15 5 0	15 10 0	15 0 0
Feeding Treacle	60·0	14 15 0	17 0 0	—	—	17 0 0	16 0 0
Linseed	153·5	28 10 0	30 0 0	30 3 1	30 3 1	—	28 10 0
Linseed Oil	250·0	50 0 0	‡56 0 0	47 0 0	5s. gal.	—	—
Egyptian Cotton Seed... ...	108·6	19 0 0	—	19 15 0	—	—	—
Bombay Cotton Seed	99·6	—	—	—	—	—	—
Cotton Seed Oil	250·0	*49 0 0 †52 10 0	‡60 0 0	—	—	—	—
Fish Meal	145·0	—	—	—	—	14 0 0	15 10 0
Locust Bean Meal	80·0	—	—	—	—	—	—

* Naked. † Refined. ‡ In barrels.

the whole of the dry fodder can be supplied by grass. In winter only about one-sixth of the dry fodder need be in the form of concentrated food, and this may all be some kind of oil-cake. On the average for the whole year it is estimated that about half a million tons of concentrated food are consumed by cows in producing nearly eight million tons of milk containing about one million tons of dry human food. The cow is, therefore, not an extravagant animal from the tonnage point of view, for every ton of imported concentrated food induces the production of about 2 tons of dry human food in the form of milk. The imports of oil-seeds are sufficient to yield nearly a million tons of cake per year, so that as far as quantity goes there should be no great difficulty in obtaining enough cake to keep up the milk supply.

Beef and mutton are in quite a different category. During the summer, grass-fed beef and mutton can be produced with practically no call on tonnage for importing food, but for winter feeding by ordinary methods it is usual to employ about 2½ lb. of concentrated food, in addition to roots, hay, and straw, for each 1 lb. of beef or mutton produced. Thus, for the 700,000 tons of beef and mutton produced annually in the winter months it has been customary to use about 1,700,000 tons of concentrated food. It is quite certain that the amount available during the next 12 months will fall far short of this amount. It will, therefore, be necessary to change the system of feeding so as to use a far smaller proportion of concentrated food.

Pigs are, on the whole, economical converters of feeding stuffs into human food. It is commonly accepted that about 7 lb. of meal will produce 1 lb. of pork, from which it follows that about 6 lb. of dry feeding stuff will produce 1 lb. of dry human food in the form of pork or bacon. When considered from the point of view of tonnage, however, the pig becomes a most extravagant animal, for his food consists almost entirely of cereals which are imported or which could be used for human food to save imports. In these circumstances no one can well complain if the shipping authorities do not import 7 lb. of grain to be used for making 1 lb. of pork. With ships so scarce it is far wiser from the national point of view to import 7 lb. of wheat which will yield 5½ lb. of flour and 1½ lb. of offals, from the latter of which the farmer can produce about 2 oz. of dry human food in the form of milk or bacon.

From this point of view poultry must be regarded as even worse than pigs, for the hen lives chiefly on corn and is a much

TABLE II.

LONDON. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	2	3¼	English beans	3	6½
Maize gluten feed ..	2	8¾	Argentine maize ..	3	6¾
Decorticated cotton meal	2	9½	Malt culms	3	7
Soya bean cake	2	11	English dun peas ..	3	8
Wheat middlings ..	2	11	Wheat bran (broad) ..	3	8½
Distillers' grains (English)	2	11¾	Linseed	3	8¾
Distillers' grains (French)	2	11¾	Cotton seed oil (naked) ..	3	11
American linseed cake ..	3	0½	Linseed oil	4	0
Coconut cake	3	2¾	English maple peas ..	4	0¼
Wheat sharps	3	3	Rice bran	4	1½
English linseed cake ..	3	3½	Maize meal	4	2
Palm kernel cake ..	3	4	Cotton seed oil (refined)	4	3
Palm kernel meal ..	3	4¼	Egyptian cotton cake ..	4	4½
Maize germ meal ..	3	4½	English feeding barley ..	4	4½
American maize ..	3	4½	Bombay cotton cake ..	4	6½
Brewers' grains (dried)	3	5¼	English oats	4	9
Egyptian cotton seed ..	3	6	Argentine oats	4	10½
Wheat bran	3	6½	Feeding treacle	4	11

TABLE III.

LIVERPOOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Maize gluten feed ..	2	8¾	English beans	3	10¼
Distillers' grains (English)	2	9¼	Maize meal ..	3	10½
Decorticated cotton cake	2	10	Malt culms	3	10½
Wheat pollards	2	10½	Linseed	3	11
Indian linseed cake ..	2	11¼	Wheat bran	3	11½
Palm kernel cake ..	3	1	Burmese rice meal ..	4	0
English linseed cake ..	3	3	Egyptian cotton cake ..	4	4½
American maize ..	3	3	Linseed oil	4	6
Wheat sharps	3	3½	English oats	4	7¼
Maize germ meal ..	3	4½	Bombay cotton cake ..	4	8
Argentine maize ..	3	5	Cotton seed oil	4	9½
Chinese beans	3	6½	Feeding treacle	5	8

TABLE IV.

HULL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	English dun peas ..	3	8
Ground nut cake ..	2	3½	Wheat bran	3	9
Wheat middlings ..	3	0	Linseed oil	3	9
English linseed cake ..	3	2	English maple peas ..	3	10½
Wheat sharps	3	2½	Linseed	3	11¼
Malt culms	3	3½	Maize meal	4	1
Maize germ meal ..	3	4	Wheat bran (broad) ..	4	1½
Brewers' grains (dried) ..	3	5¼	Egyptian cotton cake ..	4	3¼
English beans	3	5¼	Bombay cotton cake ..	4	5½
Argentine maize ..	3	6¾	English feeding barley ..	4	5½
Egyptian cotton seed ..	3	7	English oats	4	7

TABLE V.

BRISTOL. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Maize gluten feed ..	2	8¾	Brewers' grains (dried) ..	3	5
Decorticated cotton cake	2	10	Argentine maize	3	5½
Distillers' grains (English)	2	11¾	Wheat bran	3	9½
Wheat sharps	3	2½	Wheat bran (broad) ..	3	10
Palm kernel cake ..	3	3¼	Maize meal	3	11¼
Coconut cake	3	3½	Linseed	3	11¼
English linseed cake ..	3	4½	Egyptian cotton cake ..	4	4½
Malt culms	3	4½	English feeding barley ..	4	4¾
English beans	3	4½	English oats	4	8¾
Maize germ meal ..	3	5			

TABLE VI.

AVERAGE PRICES PER FOOD UNIT.

LONDON, LIVERPOOL, HULL AND BRISTOL.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	11¾	Malt culms	3	6½
Ground nut cake ..	2	3½	English beans	3	6½
Maize gluten feed ..	2	8¾	Chinese beans	3	6½
Decorticated cotton meal	2	9½	Egyptian cotton seed ..	3	6½
Decorticated cotton cake	2	10	English dun peas ..	3	8
Wheat pollards	2	10½	Wheat bran	3	9¼
Soya bean cake	2	11	Linseed	3	10½
Distillers' grains (English)	2	11	Wheat bran (broad) ..	3	10¾
Indian linseed cake ..	2	11¼	English maple peas ..	3	11¼
Wheat middlings ..	2	11½	Burmese rice meal ..	4	0
Distillers' grains (French)	2	11¾	Maize meal	4	0¼
American linseed cake ..	3	0½	Linseed oil	4	1
Palm kernel cake ..	3	2¾	Rice bran	4	1½
Wheat sharps	3	2¾	Cotton seed oil ..	4	4
Coconut cake	3	3	Egyptian cotton cake ..	4	4½
English linseed cake ..	3	3¼	English feeding barley ..	4	4¾
American maize ..	3	3¾	Bombay cotton cake ..	4	6¾
Palm nut meal	3	4¼	English oats	4	8
Maize germ meal ..	3	4½	Argentine oats	4	10½
Brewers' grains (dried) ..	3	5¼	Feeding treacle	5	3½
Argentine maize	3	6			

TABLE VII.

GLASGOW. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Fish meal	1	11¼	Malt culms	3	7
Ground nut cake ..	2	5¾	Maize	3	8
Distillery mixed grains (dried)	2	8¾	Bean meal	3	9¼
Decorticated cotton cake	2	11¼	Wheat bran	3	10¼
Indian linseed cake ..	3	0¾	Wheat bran (broad) ..	3	10½
Wheat sharps	3	2½	Maize meal	4	0½
Brewers' grains (dried)	3	2¾	Rice meal	4	2½
English linseed cake ..	3	3	Oats	4	6
Palm kernel cake ..	3	4½	Egyptian cotton cake ..	4	6¼
Wheat middlings ..	3	6½	Feeding treacle	5	8¼

TABLE VIII.

LEITH. PRICES PER FOOD UNIT.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Palm kernel cake ..	3	5¼
Distillery mixed grains (wet)	2	0	Maize	3	7
Fish meal	2	1¾	Wheat bran	3	7½
Distillery mixed grains (dried)	2	10½	Linseed	3	8¾
Decorticated cotton cake	3	0	Wheat bran (broad) ..	3	9
Indian linseed cake ..	3	1	Malt culms	3	10¼
English linseed cake ..	3	2½	Maize meal	4	0¼
Wheat sharps	3	2½	Oats	4	4¾
Wheat middlings ..	3	3¼	Egyptian cotton cake ..	4	6¼
Brewers' grains (dried)	3	4½	Bombay cotton cake ..	4	10
			Feeding treacle	5	4

TABLE IX.

AVERAGE PRICES PER FOOD UNIT.
GLASGOW AND LEITH.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	8	Wheat middlings ..	3	5
Distillery mixed grains (wet)	2	0	Maize	3	7½
Fish meal	2	0½	Linseed	3	8¾
Ground nut cake ..	2	5¾	Malt culms	3	8¾
Distillery mixed grains (dried)	2	9½	Wheat bran	3	9
Decorticated cotton cake	2	11¾	Bean meal	3	9¼
Indian linseed cake ..	3	1	Wheat bran (broad) ..	3	9¾
Wheat sharps	3	2½	Maize meal	4	0¼
English linseed cake ..	3	2¾	Rice meal	4	2½
Brewers' grains (dried)	3	3½	Oats	4	5¼
Palm kernel cake ..	3	4¾	Egyptian cotton cake ..	4	6¼
			Bombay cotton cake ..	4	10
			Feeding treacle	5	6

more extravagant converter of feeding stuffs into human food than the pig, about 15 lb. of dry feeding stuff being required to produce 1 lb. of dry human food in the form of eggs and fowl.

In the present situation it is necessary to make the best possible use of the reduced supply of concentrated foods for animals. This will be achieved as follows:—

Working horses must get their normal allowance. *Horses used for pleasure or for unnecessary work* should get the minimum allowance of concentrated food or should be turned out to grass. *Milking cows* should get their normal allowance, since milk is a necessary food for infants and invalids, and since cows make very good use of their concentrated food. *For all kinds of fattening animals* the allowance of concentrated food should be greatly reduced, because fattening animals are wasteful converters of concentrated fodder into human food. This remark applies also to pigs and poultry. *Pigs and poultry*

should be limited in numbers by the supply of waste products and other materials available for their keep which are not suitable for human food. Thus it is economical from the national point of view to keep as many pigs and fowls as can be fed chiefly on roots, grass, and town or household refuse with a small addition of corn or meal. It is wasteful from the national point of view to increase the number kept to such an extent as makes it necessary to use a large amount of corn or meal.

Horses.—The present high price of oats is a sufficient index of their scarcity, and a sufficient inducement to replace them by other articles. The following ration may be used to replace 12 lb. of oats for farm horses :—

3 lb. dried grains.	1 lb. gluten feed.
4 ,, maize.	1 ,, linseed cake.

This ration supplies rather less starchy material and rather more protein than 12 lb. of oats. Its extra protein content may be balanced by an allowance of 10 or 12 lb. of roots per head per day, which will make up the deficit of starchy material.

For nags or ponies at work in towns a mixture of dried grains, gluten feed, sharps or pollards and oats, in equal proportions, may be used to replace oats, weight for weight.

In-foal mares should get their normal allowance of oats.

Milking Cows.—The ration suggested last month—2 lb. of decorticated cotton cake and 3 lb. of maize gluten feed—is still as economical a ration as can be desired for milking cows giving about 2 gal. a day. It is intended as an addition to a normal ration of roots, hay, straw or other coarse fodder, and is suitable for a cow weighing about 10 cwt., but should be increased or decreased if the cows exceed or fall short of this weight. For cows giving more than 2 gal. a day, an extra 2 lb. of the mixture should be used, and the root ration should also be increased by 7 lb. An alternative ration is $1\frac{1}{2}$ lb. of ground-nut cake and $3\frac{1}{2}$ lb. of maize gluten feed.

Cattle Fattening for Beef.—At present prices and with the existing difficulty of importing feeding stuffs, the ration of concentrated food should be reduced as low as possible. If plenty of roots are available 3 lb. of one of the cakes rich in protein, such as ground-nut or decorticated cotton cake, rising to 4 lb. in the latter stages, will produce good results. The amount of cake used should also be reduced by selling the animals for slaughter as soon as their rate of increase in live weight begins to slacken. This usually happens at the end of about 4 months in the yards.

Sheep Fattening on Roots should also get a low ration of one of the more nitrogenous cakes.

Ewes with Lambs.—One of the following mixtures will be found suitable:—

I.—Linseed cake .. 2 parts.
Dried grains .. 1 part.
Malt culms .. 1 „
Beans .. .. 2 parts.

II.—Ground-nut cake 1 part.
Dried grains .. 2 parts.
Malt culms .. 1 part.
Beans .. .. 1 „

For ewes with single lambs, ¾ lb., rising to 1 lb. As soon as the lambs will eat, they may get, through creeps, 2 oz. per head per day, which should gradually be increased and the mother's ration reduced. For ewes with doubles the ewe's ration should begin at 1 lb.

TABLE X.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible			Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
		Protein.	Fat.	Carbo-hydrates and Fibre.		
Foods Rich in both Protein and Oil or Fat.						
Ground nut cake	1 : 0.8	45.2	6.3	21.1	77.5	102
Soya bean cake	1 : 1.1	34.0	6.5	21.0	66.7	88
Decort. cotton cake ..	1 : 1.2	34.0	8.5	20.0	71.0	93
Linseed cake, Indian ..	1 : 1.9	27.8	9.3	30.1	77.1	101
Linseed cake, English ..	1 : 2.0	26.7	9.3	30.1	76.0	100
Cotton cake, Egyptian ..	1 : 2.1	15.5	5.3	20.0	40.0	53
Cotton cake, Bombay ..	1 : 2.5	13.1	4.4	21.5	37.6	49
Distillers' grains (English) .. Distillers' grains (French)	1 : 2.9	18.7	10.2	29.0	57.3	75
Maize gluten feed	1 : 3.0	20.4	8.8	48.4	87.4	115
Brewers' grains, dried ..	1 : 3.5	14.1	6.6	32.7	50.3	66
Coconut cake	1 : 3.8	16.3	8.2	41.4	76.5	101
Palm kernel cake	1 : 4.5	14.1	6.1	48.9	76.7	101
Linseed	1 : 5.9	18.1	34.7	20.1	119.2	157
Bombay cotton seed ..	1 : 6.6	11.0	16.8	30.1	77.5	102
Fairly Rich in Protein, Rich in Oil.						
Maize germ meal	1 : 8.5	9.0	6.2	61.2	81.0	107
Rice meal	1 : 9.4	6.8	10.2	38.2	68.4	90
Rich in Protein, Poor in Oil.						
Fish meal	1 : 0.1	54.0	4.0	—	60.0	78
Peas, Calcutta white ..	1 : 2.1	23.3	1.1	45.9	66.9	88
Beans, English	1 : 2.6	19.3	1.2	48.2	67.0	88
Beans, Chinese	1 : 2.6	19.6	1.7	47.9	67.0	88
Peas, English maple ..	1 : 3.1	17.0	1.0	50.0	70.0	92
Palm-nut meal (extracted)	1 : 3.4	15.6	1.9	48.7	66.1	87
Brewers' grains, wet ..	1 : 3.5	3.5	1.5	8.6	12.7	17
Malt culms	1 : 3.6	11.4	1.1	38.6	38.7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.						
Barley, feeding	1 : 8.0	8.0	2.1	57.8	67.9	89
Oats, English	1 : 8.0	7.2	4.0	47.4	59.7	79
Oats, Argentine	1 : 8.0	7.2	4.0	47.4	59.7	79
Maize, American	1 : 11.5	6.7	4.5	65.8	81.0	107
Maize, Argentine	1 : 11.3	6.8	4.5	65.8	83.5	110
Maize meal	1 : 13.0	5.5	3.5	63.9	77.8	102
Wheat middlings	1 : 4.8	12.8	4.1	52.5	73.1	96
Wheat sharps	1 : 5.1	11.6	3.4	51.6	62.0	80
Wheat pollards	1 : 4.5	13.6	3.7	52.5	62.1	82
Wheat bran	1 : 4.7	11.3	3.0	45.0	49.7	65
Wheat bran, broad ..	1 : 4.7	11.3	3.0	45.4	48.1	63
Locust bean meal ..	1 : 22.1	4.0	0.7	69.2	71.4	94

Young Stock.—No better food at present prices can be used for young stock than a mixture of five or six parts of maize and one part of linseed ground together.

Pigs.—For weaning from 6 to 10 weeks old the cheapest food is the finer wheat offals, which are cheaper this month. After 10 weeks the consumption of concentrated food should be reduced by using roots and grass or other green stuffs. About 3 bush. of pulped roots and 1 stone of some fairly nitrogenous food, such as gluten feed, palm kernel meal or cake, make a suitable mixture. When on grass or green stuff the pigs should get about ½ lb. per head per day of palm kernel cake, gluten feed, coconut cake, or peas or beans. They may be finished on wheat offals. By this method the consumption of concentrated food may be reduced from 6 or 7 lb. per lb. of pork to about 3 lb.

Notes on Manures in March:
From the Rothamsted Experimental Station.

THE spring dressings for cereals should now go on. Under present conditions it will be well to use them liberally so as to ensure getting as large a return as possible. Sulphate of ammonia is practically the only quick-acting nitrogenous manure available, and it may be used at the rate of anything between ¾ cwt. and 1½ cwt. per acre. The past winter has been drier than that of 1915-16, so that there has been less wastage of soil nitrates by washing, but after the recent cold conditions there is nothing better than a quick-acting nitrogenous fertiliser for stimulating plant growth. Nitrate of soda would be the ideal thing, but it is not available. The next best is sulphate of ammonia; the amount required depends on the preceding crop.

Wheat after mangolds or potatoes well manured last year will probably want nothing, though if it is suffering from the cold and threatens to be very backward it might receive ¾ cwt. of sulphate of ammonia per acre. Corn, after a previous corn crop, however, or after roots that were not well manured, requires more help, and should receive 1 cwt. or even 1½ cwt. per acre. Where soot can be obtained it can be used with great advantage, both for the sake of the warmth and the nitrogen. A bushel of soot contains about 1 lb. of nitrogen, as much as is present in 5 lb. of sulphate of ammonia. A quantity of 20 to 30 bushels per acre is a common application; this is nearly equivalent to 1 to 1½ cwt. of sulphate of ammonia per acre.

Barley taken after roots will not require added nitrogen, but it often repays the application of phosphates, the addition of which helps to prevent laying of the crop and thus saves labour at harvest time. *Oats*, on the other hand, especially winter and semi-winter varieties, usually pay for extra nitrogen, and may well receive 1 cwt. of sulphate of ammonia; not only is more grain obtained but more straw as well, which in present circumstances is a valuable asset.

Roots.—It is also necessary to prepare the manurial scheme for the root crops. Where there is sufficient farmyard manure this will form the best basis, but where this is absent some of the organic manures can be used instead. There are a number of these but supplies are no longer always available. Already fish guano, which was freely offered some time ago, is now only offered on condition of its being obtainable. Shoddy is available, however, and attention may once more be directed to the fact that it possesses considerable manurial value both on light soils and on heavy loams. On an average it gave at Rothamsted nearly 40 per cent. increase in crop in the first year, besides having an appreciable effect both in the second and third years. It is used at the rate of about half a ton per acre and is ploughed in at the last ploughing.

Leather Dust.—A caution must again be given about leather dust. Some of this material recently came to hand from an allotment committee, having been offered to them as a suitable dressing for their allotments. There is no evidence that leather dust possesses any value as manure, and it should never be bought for this purpose. Processes are in hand for treating it so as to make the nitrogen available, and one or other of these may turn out a success; but the crude, untreated material is valueless as far as is known. This remark does not apply to the soft leather scraps obtained from glove factories; these form valuable applications in the glove districts of Worcestershire; they are put into the soil with young sprouts, cabbages, etc., at the time of setting-out and afford a useful root manure.

Potash.—A satisfactory potash fertiliser is now on the market, and considerable quantities appear to be available; one grade has approximately the same composition as kainit and another is richer. A certain amount of pure sulphate of potash is also being manufactured.

Lime.—One of the most important of the manurial schemes is the provision of lime, limestone or chalk. All farmers know that these materials give good results under proper conditions,

but few make as much use of them as they should. In old days liming or chalking was a serious business; lime was used in large dressings, as much as a bushel to the rod being not infrequent, while chalk was applied at the rate of 60 or more loads per acre. With the introduction of modern grinding machinery, however, it is possible to break up lime and limestone to a much finer state than ever before, and in consequence much smaller dressings will suffice.

The great point for the farmer at the moment is to ascertain as far as he can which of his fields appear to want lime. The land and the soil are for present purposes sufficient guide. Briefly speaking, the indications of the need of lime are as follows:—

1. If clover fails to start well, or to stand the winter, or looks bad in spring. On a Suffolk farm recently examined, lucerne was failing in patches and weeds were consequently getting a firm hold. A similar occurrence was investigated on a Norfolk farm. The amounts of lime in the soil were:—

	Suffolk.		*Norfolk.*
On the good parts ..	0·8	..	9·6 per cent. calcium carbonate.
" bad patches ..	0·07	..	0·2 " " " "

2. If swedes, turnips or cabbages get finger-and-toe rather badly. The Armstrong College experiments have shown that 2 tons per acre of ground lime, or 3½ tons per acre of ground limestone, afford suitable dressings in such a case.

3. If mayweed springs up vigorously among the wheat, or if spurrey, sorrel, or bent grass are prevalent.

It is hoped that some arrangements may be possible whereby liming will be facilitated, and in that event it will be very useful if farmers can ascertain by observation which of their fields stand in need of lime.

Those who are fortunate enough to be able to command lime and labour now may proceed to apply at the rate of 10 cwt. to 2 tons of lime, or 1 to 4 tons of ground limestone; the smaller dressings can be used for light soils, and the larger ones for heavy soils, or soils in bad physical condition.

There are various qualities of lime which receive different local names. The best builders' lime is not necessarily the best for agricultural purposes. Cob lime may be used, and is cheaper than ground lime, but more costly to spread. Neither cob nor ground lime can be stored in bags. Sometimes lime ashes, lime mud, or other waste products are available, but they are so variable in composition that they should only be bought on analysis.

ROTATION LIME EXPERIMENT. KILMARNOCK. 1902–8.

Plot 1. No Lime applied throughout Rotation.	*Plot 2.* 4 tons per acre Burnt Lime applied in one dressing in winter (1901-2) slaked on stubble, spread and ploughed in. No further liming throughout Rotation.	*Plot 3.* 2 tons per acre Burnt Lime applied at same time as on Plot 2, and other 2 tons applied in same way two years later on land ploughed for seeds.	*Plot 4.* 1 ton per acre Burnt Lime applied every year for 4 years.	*Plot 5.* ½ ton per acre Burnt Lime applied every year.	*Plot 6.* 5 cwt. per acre Burnt Lime applied every year.	*Plot 7.* 4 tons per acre Gas Lime applied in one dressing in winter (1901-2) on stubble, spread and ploughed in. No further liming throughout Rotation.
Yield per acre, 1902 (average of 3 series only)— *Turnips*, 21 tons 10 cwt.	Tons cwt. qr. 24 11 2	Tons cwt. qr. 24 0 0	Tons cwt. qr. 21 11 2	Tons cwt. qr. 23 3	Tons cwt. qr. 22 4 1	Tons cwt. qr. 22 18 1
Yield per acre, 1903 (average of 4 series)— *Barley* { Grain (total), 2,520 lb. .. / Straw and chaff, 43 cwt. ..	2,665 lb. 45½ cwt.	2,885 lb. 44¼ cwt.	2,690 lb. 42 cwt.	2,655 lb. 40¾ cwt.	2,580 lb. 41½ cwt.	2,750 lb. 42¾ cwt.
Yield per acre, 1904 (average of 4 series)— *Hay* { First cutting, 34½ cwt. .. .. / Second „ 17¾ „	36¼ cwt. 17¾ „	35¾ cwt. 16½ „	34 cwt. 17 „	36 cwt. 18 „	34½ cwt. 17 „	33¼ cwt. 16 „
Yield per acre, 1905 (average of 4 series)— *Oats* { Grain (total), 2,600 lb. .. .. / Straw and chaff, 36¾ cwt. ..	2,490 lb. 36¼ cwt.	2,790 lb. 34 cwt.	3,005 lb. 34½ cwt.	3,105 lb. 34 cwt.	3,105 lb. 35¾ cwt.	2,975 lb. 35½ cwt.
Yield per acre, 1906 (average of 4 series)— *Potatoes*, 8 tons 9 cwt. 3 qr.	Tons cwt. qr. 7 18 0	Tons cwt. qr. 7 13 2	Tons cwt. qr. 7 14 3	Tons cwt. qr. 8 4 0	Tons cwt. qr. 7 15 0	Tons cwt. qr. 7 19 2
Yield per acre, 1907 (average of 4 series)— *Wheat* { Grain (total), 3,040 lb... .. / Straw and chaff, 61½ cwt. ..	2,980 lb. 64½ cwt.	3,600 lb. 62¾ cwt.	3,760 lb. 62 cwt.	3,680 lb. 61¼ cwt.	3,560 lb. 61½ cwt.	3,580 lb. 60¾ cwt.
Yield per acre, 1908 (average of 4 series)— *Hay* { First cutting, 30 cwt. .. .. / Second „ 8 „	38 cwt. 9 „	37¾ cwt 10 „	38½ cwt. 10¾ „	38 cwt. 12 „	35 cwt. 10 „	31¾ cwt. 7½ „

The choice between ground lime and ground limestone is largely a matter of price; 12 cwt. of ground lime have the same value to the farmer as 1 ton of ground limestone. Where the prices on this basis are equal there are some advantages in favour of ground limestone. It has usually given somewhat better crop returns. It can also be stored in the bags in which it is sent, while ground lime cannot.

Clover leys could still receive limestone, but the only land that could receive lime would be that intended for roots. Even here there is not much time; it is shown in the Aberdeen reports* that the lime must not be applied too close to the time of sowing turnips, otherwise the yield may be too depressed.

Nor should lime or limestone be put on potatoes or oats unless actual trials have shown that benefit will be obtained; as a general rule these two crops respond less than others; and in the Kilmarnock trials†, lasting over seven years, potatoes were actually injured by lime, though oats benefited by it. (See Table, p. 1266.)

Unit Prices of Artificial Manures in March.—The statement on p. 1268 shows the cost to the purchaser of 1 per cent. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres, for March, 1917.

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating, and rebagging the ingredients, bags, and loss of weight.

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* *Aberdeen and North of Scotland Agric. Coll.*, Bull. No. 4, 1904.
† *West of Scotland Agri. Coll.*, Bull. No. 55, 1911 (pp. 193-222).

—	England and Wales.										Scotland.	
	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.	Glasgow.	Leith.
Nitrogen from :	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Sulphate of Ammonia pure .. 95 %	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	—	15 6
" 93 %	—	—	—	—	—	—	—	—	—	—	—	—
Calcium Cyanamide (Nitrolim)	19 4	—	—	—	—	—	—	—	—	20 0	—	—
Nitrate of Soda pure .. 95 %	—	—	28 2½	—	—	29 0½	29 2½	—	28 4½	28 0½	—	28 4½
" 90 %	28 9	—	28 0	—	—	—	—	—	29 4	—	—	—
Nitrate of Lime ..	—	—	—	—	—	—	—	—	—	—	—	—
Castor Meal	—	—	24 6½	—	—	—	—	—	—	—	—	—
Allowed for Insol. Phos.	—	—	*2 0*	—	—	—	—	—	—	—	—	—
Allowed for Potash ..	—	—	*15 0*	—	—	—	—	—	—	—	—	—
Soluble Phosphates from :												
Superphosphate 35 %	3 4	—	3 6	4 0	3 7½	3 7	3 6	3 5	—	—	—	—
" 33 %	3 4	—	3 5	—	—	3 6½	3 6	3 5	—	—	—	—
" 30 %	3 3½	—	3 6	3 10	3 8	3 7	3 6	3 5	—	—	4 2	—
" 26 %	3 7½	—	3 10	4 3	4 0½	3 11½	3 10	3 9	—	—	—	—
Dissolved Bones ..	5 9	—	5 5½	—	4 11½	5 3	5 2½	5 8½	5 11	5 8½	—	—
Allowed for Nitrogen ..	*22 7*	—	*21 3½*	—	*19 6½*	*20 7*	*20 6½*	*22 4½*	*22 3*	*23 0*	—	—
Allowed for Insol. Phos.	*3 3½*	—	*3 1½*	—	*2 10½*	*3 0*	*3 0*	*3 3*	*3 3*	*3 3½*	—	—
Insoluble Phosphates (Citric Soluble) from:												
Basic Slag	2 9½	—	2 9½	—	—	—	—	—	—	3 5½	3 3½	3 3½
Insoluble Phosphates from :												
Basic Slag	—	—	2 3½	2 0	—	1 11½	—	—	—	2 9	—	—
Bone Meal	3 0½	—	2 11	2 8	2 9½	2 11	2 11½	2 10½	3 0½	3 1½	—	—
Allowed for Nitrogen ..	*20 9*	—	*19 10*	*18 3½*	*19 1*	*20 0*	*20 1½*	*19 6½*	*21 0*	*21 4½*	—	—
Steamed Bone Flour ..	2 6½	2 8	3 0	2 6½	—	2 5½	—	2 4½	2 7½	2 9	—	3 1
Allowed for Nitrogen ..	*17 6*	*17 10*	*20 5*	*17 4½*	—	*16 11*	—	*16 3½*	*17 11*	*18 9*	—	*15 6*
Fish Guano	—	4 0½	2 10	—	—	—	—	—	—	—	—	—

A Standard Dietary.

IT may be of interest at the present time to publish the following figures relating to the consumption of food at a large convalescent home in the vicinity of London, in the year 1913. They are based on an accurate record of the food consumed from day to day. This record was kept on a cost basis, and in converting the cost figures into quantities average pre-war prices have been used. The dietary may be taken to represent an economical and yet liberal diet for a middle-class adult taking moderate exercise; for a child under 12, or a very old person, the figures could be safely diminished by one third; for a man doing out-door physical work an addition of at least 30 per cent. should be made.

Description of Food.	Actual Cost per head per week in pence, 1913.	Estimated Quantity.
Butcher Meat	19·5	1 lb. 14 oz.
Fish	2·3	4½ oz.
Poultry	5·7	7½ "
Bacon	8·0	11 "
Eggs	1·9	1½ (eggs)
Cheese	2·4	3½ oz.
Butter	6·4	7 "
Milk	8·0	2 qt.
Bread and Flour	5·8	4 lb.
Sugar	2·5	1 "
Groceries	7·5	—
Vegetables and Fruit ..	3·5	—
Liquors, etc.	2·7	—
Total cost	76·2	
or	6s. 4¼d.	

Extracting the principal food stuffs we get the following figures :—

Meat of all kinds (including fish)	3 lb. 5 oz.	per week.
Cheese	3½ "	"
Butter	7½ "	"
Milk	2 qt.	"
Sugar	1 lb.	"
Bread and flour	4 "	"

In order to bring this dietary within the Food Controller's scale, the only alterations necessary are that the sugar must be cut down by ¼ lb., the meat, bacon and poultry (not the fish) must be reduced by ½ lb. in the aggregate; and the bread and flour ration would be confined to bread only. Dietetic equivalents of these reductions would be 2 oz. butter, together with 8 oz. cheese, approximately.

Co-operation in the Marketing of Small Produce.

IN marketing his produce the individual smallholder is at a great disadvantage compared with the large grower. As he can only send small consignments his expenses are necessarily proportionately greater. While one cart may carry the daily produce of the larger holding to the railway, six small growers may send the same quantity in six carts; and the cost of the railway transport for small quantities of produce is much greater proportionately than for large quantities (see this *Journal*, November, 1915, p. 783). Further, the large producer is in a better position to grade and class his goods for market. Fortunately, the smallholder will be able to find a solution to these difficulties if he will co-operate with his neighbours. Co-operative movements must of necessity have small beginnings, and the activities of the Produce Committee of Upton-on-Severn afford an excellent object-lesson. This Committee (inaugurated in 1914, shortly after the outbreak of the War) collects at a central depot and markets several tons of produce weekly from some 25 parishes.

The work is mostly done on the co-operative principle, by the members, the only expense being for a small amount of book-keeping and for packing.

The modest capital of about £200 is at present provided by a guarantee, but this, too, will probably shortly be raised among the members themselves.

The success of this Committee, in spite of difficulties of transport beyond its control, has induced the Agricultural Organisation Society to organise similar efforts throughout the county of Worcestershire. A beginning has been made with the Droitwich district, and the Bromsgrove Rural District is to follow.

In many parts of the country there now exist small societies engaged in the praiseworthy task of sending vegetables to the Grand Fleet. Later on, these societies might well form the bases for similar experiments in co-operative marketing. The work of grading and packing for sale should form an excellent outlet for women's activities, while increased means of communication, which should follow the close of the War, would greatly facilitate the centralisation both of goods to be packed and hands to pack them.

Tring and District Sparrow Club.

THE Tring and District Sparrow Club, which was formed in 1914 with the object of reducing the damage done by sparrows in the district, has now completed three years' operations. During this time the sparrows killed have numbered 39,058, and it is recognised that the district is much more free from the pest than in former years.

Some notes on the work of the Club were given in the *Journal* for May, 1916, p. 159. It may be recalled that the Club consists of :—

(1) Honorary Members whose annual subscription is not less than 5*s*.

(2) Working Members who subscribe 2*s*. 6*d*. per annum for every 50 acres or portion of 50 acres farmed by them.

The Club pays members at the rate of 3*d*. per dozen heads of sparrows which have been killed within a 4-mile radius of Tring. The number of sparrows killed rose from 9,302 in 1914, to 14,143 in 1915, and to 15,163 in 1916. There were, in 1916, 43 ordinary and 7 honorary members.

As regards the financial position of the Club a balance of £10 on the first year's working rose to £16 10*s*., on the second, and to £19 11*s*., on the third year's working, so that the Club has been conducted very successfully from the financial point of view as well.

The following is the statement of accounts for 1916 :—

	£	s.	d.			£	s.	d.
To Balance brought forward from 1915 ..	16	9	11	By Amounts paid for 15,613 sparrows' heads		16	4	8
,, 43 Working members' subscriptions for 1916	17	17	6	,, Printing & stationery			8	6
,, 7 Honorary members' subscriptions for 1916	1	7	6	,, Stamps			2	6
,, Dividends on Investment	0	12	2	,, Balance in hand :	£ s. d.			
				5 per cent. Exchequer Bonds ..	15 0 0			
				Cash in hands of Secretary	4 11 5			
						19	11	5
	£36	7	1			£36	7	1

Accounts of the operations of the Ixworth and District Sparrow Club and of sparrow clubs at Angmering and Slinfold were given in the *Journal* for December, 1916, p. 868

Report of the Development Commissioners for 1915-16.

DURING the year ended 31st March, 1916, the Development Commissioners pursued the policy of confining advances from the Development Fund mainly to schemes already established with the expectation of continued help from the Fund (for which just sufficient advances were recommended to secure continuity), and to new schemes only where they had some bearing upon national requirements arising from the War,

e.g., the increase of the food supply and of natural products such as the provision of plants for afforestation.

The preparation of projects of development which would have the effect of employing a large amount of labour after the War has continued to receive attention.

Agricultural Research and Education in England and Wales.—It has been found possible to maintain to some extent the work of the newly-founded research institutes. Large reductions have been made in the grant provided for the establishment of farm institutes; and local education authorities have been asked to make every possible economy in present expenditure, and not to proceed with their building or extension schemes during the War. For the continuance of the research scheme in England and Wales during 1916–17 the following grants to the Board of Agriculture and Fisheries have been sanctioned:—

Grants to Colleges and Institutions in aid of—		£
(*a*) Scientific research and experiment		19,150
(*b*) The extension of advisory and local investigation work		8,000
(*c*) Special investigations and research		900
Research scholarships		1,500
Expenses of administration		890
		£30,440
Research in animal pathology to be undertaken at the Board's Veterinary Laboratory, 1916–17		£ 1,500
Research Institute in Plant Pathology at Kew—		
(*a*) Salaries, wages, and maintenance expenses, 1916–17	£ 1,254	
(*b*) Adaptation of the land acquired for the Institute	430	
		1,684

A grant to the Board of £17,300 was recommended to meet expenditure on the farm institute scheme during the year 1916–17, the only new expenditure contemplated by local education authorities being in respect of schemes of instruction arising out of the war. A grant of £1,200 was also recommended in aid of the expenses during 1916–17 of the advisory councils established in connection with this scheme and the scheme for the improvement of live stock.

Last year the Commissioners recommended a grant to the Board of Agriculture and Fisheries of £3,000 for plant and working capital in order to start in Warwickshire the rural industries of vegetable drying and fruit canning. Experiments are being carried out under the supervision of a committee appointed by the Board in order to test the prospect of these industries on a commercial scale. In February last the Commissioners recommended a further advance of £3,000 to extend the present factory accommodation at Broome, and for the provision of additional machinery and equipment for the manufacture of cans which could no longer be bought. The venture is serving a useful purpose in the supply of fruit and vegetables to the Army.

A grant of £5,000 for 1916–17 has been sanctioned to enable the Board in consultation with the Commissioners to assist emergency schemes of an educational or quasi-educational character. From this grant a sum of £1,500 was sanctioned in aid of a scheme for the instruction of women in milking and other light farm work. Advances from a similar grant made last year have been approved for the establishment of a number of migratory cheese schools, to assist schemes for augmenting the production of eggs and poultry, and for the organisation of the work of the Cumberland and Westmorland Home Food Culture Committee.

An advance of £100 has also been sanctioned to assist the work of the Vacant Land Cultivation Society.

Bee-Keeping and Poultry.—The following grants were recommended:—

	£
British Bee-keepers' Association:—	
Expenses in connection with the experimental apiary at the Zoological Gardens during the period 1st October, 1913, to 31st March, 1915	313
Board of Agriculture and Fisheries:—	
(*a*) Schemes for augmenting the production of eggs and poultry by the establishment of 140 stations in England and Wales for the distribution of reliable eggs for hatching, and by the provision of two incubating stations in the Bangor provincial area ..	1,250
(*b*) Expenses of a tour by Mr. Edward Brown, for the inspection and encouragement of the Welsh poultry industry	125

Cultivation and Preparation of Flax, Hemp, and Tobacco.—The following grants were recommended:—

(1) *British Flax and Hemp Growers' Society:*—

(*a*) £3,600 in aid of a scheme for testing the possibility of establishing the hemp industry in the Fen Country. The grant enabled the Society to secure the control for a period of five years of a hemp factory at Prickwillow, Cambridge, and included £1,200 for new machinery and adaptation or construction of buildings; the balance being available for working expenses during the first year. In view of the enhanced price of hemp, and the improvement in the product which may be expected from the adoption of better machinery, it is anticipated that no further grant will be required during the five years over which the experiment is to extend, and that the greater part, if not the whole, of the grant for working expenses will be recovered.

(*b*) £2,800 for the continuance of experiments in the cultivation and preparation of flax during the year 1915–16.

(2) *Leeds University:*—£500 in aid of the investigation into the growth and treatment of flax which is being conducted at Selby by the University.

(3) *British Tobacco Growers' Society:*—£6,000 for the continuance of the work of the Society during the year 1915–16. The Society is conducting experiments in the cultivation and preparation for market of tobacco and nicotine products in order to ascertain whether tobacco can be grown in this country with profit to the grower.

Horse and Live Stock Breeding.—The following grants were recommended:—

(1) *Board of Agriculture and Fisheries:*—

(*a*) £33,000 to meet the cost of the scheme during the year 1916–17 for the improvement of heavy horses, cattle, and swine, the extension of milk-recording, and the employment of live-stock officers at agricultural institutions in England and Wales. Details of the scheme are given in the report of the Board on the administration of the grant for 1915–16, published in the Board's *Journal* for the month of August, 1916.

(*b*) £1,000 (in addition to £26,500 granted last year) in aid of the improvement of light-horse breeding during the year 1915–16.

(2) *Board of Agriculture for Scotland:*—£7,080 in aid of the scheme for the improvement of heavy horses and cattle, and the extension of milk-recording in Scotland during the year 1916–17.

(3) *Department of Agriculture and Technical Instruction for Ireland:*—£1,500 in aid of the Irish draught horse scheme during the year 1916–17.

Organisation of Co-operation among Agriculturists in England and Wales.—A grant not exceeding £8,000 to the Agricultural Organisation Society for its work during the year 1915–16 was recommended as follows:—

(*a*) A block sum of £6,000, and
(*b*) An additional sum equal to the amount of the subscription income of the Society for the year, but not exceeding £2,000.

Forestry in England and Wales.—A grant of £7,200 to the Board of Agriculture and Fisheries was recommended for the continuation in the year 1915–16 of the scheme for research work, forestry instruction and advice at five centres (Oxford, Cambridge, Cirencester, Bangor and Newcastle-on-Tyne), minor forestry experiments and expenses of forestry surveys, and work in connection with the portable wood-distillation plant at Chopwell Woods. Later in the year application was made for a reduced grant of £5,750 to continue this scheme in 1916–17. In view of the need for rigid economy and the special circumstances caused by the War, it was proposed for the present to reduce the number of advisory officers from five to four, to discontinue the grant to the University of Cambridge for research, and to restrict the experimental work of the Board. The Commissioners were satisfied with the progress of the scheme as a whole, and the grant applied for was recommended.

The following grants to the Commissioners of Woods were recommended :—

	£
(*a*) Maintenance of the Forest of Dean Demonstration Area during the year 1915–16	850
(*b*) Provision of nursery stock for emergency afforestation operations after the War	1,100

OFFICIAL NOTICES AND CIRCULARS.

CULTIVATION OF LAND—POTATOES—LABOUR AND MACHINERY —MANURES AND SPRAYING—DESTRUCTION OF GAME—MISCELLANEOUS.

THE Prime Minister has addressed the following Letter to the secretaries of County War Agricultural Committees and others interested in the production of food :—

The Prime Minister's Appeal to Farmers.

DEAR SIR,—We have now reached a crisis in the War when, to ensure victory, the heroism of our Armies at the front must be backed by the self-sacrifice and tireless labour of every one at home. To this end the production of each quarter of wheat and oats and of each bushel of potatoes is of vital importance. The work of the next few weeks must decide the harvest of the year, and in the nation's interest I urge you, at whatever personal sacrifice, to overcome all obstacles, to throw your fullest energies into the work, and to influence and encourage all who assist you so that every possible acre shall be sown.

The imperative demands of the War have made it impossible to avoid calling up men fit for active service, even though skilled in farming. As far as possible this is being met by bringing on to the land men and women from other industries. They cannot be expected to do work equal to that of men expert in agriculture, but there is no time for delay, and the Government is confident that farmers will at once step forward and do all in their power to utilise their resources to the best advantage.

The farmers of this country can defeat the German submarine, and when they do so they destroy the last hope of the Prussians.

Yours, etc.,

D. LL. GEORGE.

CULTIVATION OF LAND.

THE following Circular Letter, dated 24th February, has been addressed to the London County Council and the Councils of Boroughs and Urban Districts in England and Wales :—

Circular Letter as to Cultivation of Lands Order, 1917 (No. 2).

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Cultivation of Lands Order, 1916, and to say that he has received representations from certain Local Authorities that the powers conferred by the Order are insufficient to enable them to meet the demand for small allotments, owing to the fact that the unoccupied land which can be taken without consent is not sufficient for this purpose and that difficulties have arisen in arriving at agreements with owners and occupiers for the taking of occupied land.

2. I am to inform you that, in view of these representations Regulation 2L has been amended so as to empower the Board to enter on any land, whether occupied or unoccupied, without the necessity of obtaining the consent of the owner or occupier. An Order has been made, of which a copy is enclosed,* delegating to the Allotment Authorities in urban areas the powers conferred on the Board by the Regulation as amended, subject to the restriction that, except as regards land in the County of London or in a County Borough, the Allotment Authority may not enter on occupied land without the written consent of the occupier, unless they obtain the sanction of the War Agricultural Executive Committee of the County. This Order will supersede the Cultivation of Lands Order, 1916.

3. Mr. Prothero desires me to point out to your Council that the extended powers conferred by the new Order should be exercised with the greatest possible care and discretion. The object of the Regulation and Order is to provide land for the purpose of increasing the crops available for consumption by the public, and its powers should not be used to interfere with land which is already being fully cultivated, or with meadow or pasture land of good quality the breaking up of which would involve considerable expenditure on restoration on the termination of the occupation.

4. Mr. Prothero desires me to say also that, in view of the urgent importance of maintaining the milk supply, no land should be taken under the Order which is being used for the grazing of cows, or which is otherwise essential for dairy purposes.

5. The Regulation provides that claims for compensation in respect of land upon which the Council has entered under the Regulation may be determined, in default of agreement, by a single arbitrator under, and in accordance with, the provisions in the Second Schedule of the Agricultural Holdings Act, 1908. The Council should, however, endeavour to arrange the amount of rent to be paid in accordance with paragraph 3 of the Order for any occupied land taken under the Order. It is not necessary that the question of rent or compensation for the use of the land should be settled before entry on the land by the Council, but before entering on any land the Council should satisfy themselves that there is a reasonable probability that the payments

* Printed immediately below.

which will be made by the cultivators will be sufficient to recoup the probable outlay by the Council. Any deficiency up to an amount not exceeding £2 an acre will be met by the Board as provided by *Article 6 of the Order*, and, as stated in paragraph 3 of the Circular Letter issued by the Local Government Board on the 31st January last, a further contribution may be made in certain cases.

6. The Local Authority will still require the further consent of the Board for entry on common land, and it may not enter on any garden or pleasure-ground occupied, or usually occupied, with a dwelling-house.

7. I am to add that some Local Authorities have sought power to utilise for cultivation land in their own possession which is not immediately needed for the purpose for which it was acquired by, or transferred to, the Council and which can be used for the purpose of cultivation consistently with the trusts (if any) affecting the land, and they have assured the Board that this can be done without expense to the State.

8. Mr. Prothero does not think that public recreation grounds in populated areas, which are turfed and are used to any substantial extent for recreation, can with advantage be broken up, but there is much public land which does not fall within this category, and the new Regulation accordingly provided that your Council may arrange for the cultivation of such land, either under a contract of tenancy or otherwise, and may retain any rents or profits arising from the use of such land, provided that no claim is made on the Board for any financial assistance by way of rent, compensation, or other payment.

I am, etc.,

SYDNEY OLIVIER, *Secretary*.

The Cultivation of Lands Order, 1917 (No. 2).

WHEREAS under Regulation 2L of the Defence of the Realm (Consolidation) Regulations, 1914 (which was inserted in those Regulations by Order in Council, dated the fifth day of December, nineteen hundred and sixteen, and, as subsequently amended, is set out at the foot of this Order), the Board of Agriculture and Fisheries (hereinafter referred to as "the Board") are empowered to exercise certain powers with a view to maintain the food supply of the country and to authorise any Local Authority to exercise those powers on behalf of the Board.

And whereas the Board are of opinion that for the purpose aforesaid such Order should be made as is herein contained.

Now the Board of Agriculture and Fisheries do hereby authorise *the council of the administrative county of London and the council of* each municipal borough and urban district to exercise on behalf of the Board the powers conferred by Regulation 2L as amended as respects any land within the county of London or the borough or district, or which in the opinion of the council can conveniently be cultivated by persons residing in the county of London or the borough or district, subject nevertheless to the provisions of this Order:—

1. A council shall not enter on any garden or pleasure ground occupied or usually occupied together with a dwelling-house and shall

not enter on any common land, as defined in this Order, without a further consent given by the Board, or on any occupied land, which is not within the county of London or in a county borough, except with the written consent of the occupier of the land or with the sanction of the War Agricultural Executive Committee of the county.

2. A council shall as soon as possible after entry on any land give notice of the entry to the owner of the land if he is not the occupier thereof.

3. A council may in the case of occupied land agree to pay a rent for the use thereof but not in excess of the rent payable by the occupier for the land, or if held with other land, in excess of a fair proportion of the total rent so payable, or where the land is occupied by the owner, in excess of the annual value for the purposes of income tax together with the tithe rentcharge (if any).

4. A council may arrange with any society having for its object the cultivation of vacant land for the cultivation of any land on which the council has entered, and may delegate to such society such of the powers of the council under this Order as may be necessary for the purposes of the arrangement.

5. A council may purchase any seed, manures or implements required for the cultivation of the land and sell any article so purchased to the cultivators, or allow their use of the implements at a price or charge sufficient to cover the cost of purchase.

6. A council shall as far as practicable arrange that the payments made by the cultivators for the use of the land shall cover the cost incurred by the council in providing the land or adapting it for cultivation, and shall not incur any expenses in the exercise of the powers hereby conferred (except in respect of compensation payable under subsection (3) of Regulation 2L or payable under subsection (4) of that Regulation in respect of any deterioration of the land) which will involve the Board in a liability to repay the council a total amount exceeding two pounds for each acre provided by the council.

7. An arrangement with a person or society for the cultivation of the land shall be subject to determination by the council or the Board at any time by notice to that person or society, and shall not provide for payment of compensation to that person or society in excess of the value at the time of quitting of the crops growing on the land and the labour expended upon and manure applied to the land since the taking of the last crop in anticipation of a future crop or provide for the payment of any compensation if the determination takes effect on or after the 1st January, 1918.

8. The land shall not be used for the production of vegetable crops which continue productive for more than one year or for grazing.

9. A separate account shall be kept by a council of all its receipts and expenditure under this Order or the Order hereby revoked, which shall at any time be open to inspection by an officer of the Board.

10. In this Order the expression "common land" includes any land subject to be enclosed under the Inclosure Acts, 1845 to 1882, and any town or village green and any other land subject to any right of common.

11. The Cultivation of Lands Order of 1916 is hereby revoked, but so that such revocation shall not affect the previous operation of such

Order or anything done under it, or affect any right or liability acquired or incurred under such Order, and any reference in any document to the Order hereby revoked shall be construed as a reference to this Order.

12. This Order applies only to England and Wales.

13. This Order may be cited as the Cultivation of Lands Order, 1917 (No. 2).

In witness whereof the Board have hereunto set their Official Seal this twentieth day of February, nineteen hundred and seventeen.

(Sgd.)

SYDNEY OLIVIER, *Secretary*.

REGULATION 2L AS AMENDED (SO FAR AS IT APPLIES TO ENGLAND AND WALES).

2L.—(1) Where the Board of Agriculture and Fisheries are of opinion that, with the view of maintaining the food supply of the country, it is expedient that they should exercise the powers given to them under this Regulation as respects any land, the Board may enter on the land and cultivate the land, or arrange for its cultivation by any person either under a contract of tenancy or otherwise.

(2) The Board may after entry on any land do or authorise to be done all things which they consider necessary or desirable for the purpose of the cultivation of the land or for adapting the land to cultivation, including fencing, and may also during their occupation of the land or on the termination thereof remove any such fencing or work of adaptation.

(3) Any person who cultivates land under any such arrangement shall, on the determination, by or on behalf of the Board, of the arrangement, if the determination takes effect before the first day of January nineteen hundred and eighteen, receive from the Board such compensation as may have been agreed under the terms of the arrangement, or, in default of any such agreement, as the Board may consider just and reasonable, and shall not be entitled to any other compensation.

(4) On the determination of the occupation of any land by the Board under this Regulation, compensation shall be paid by the Board to any person injuriously affected by the exercise of the powers under this Regulation, the amount of that compensation to be determined, in default of agreement, by a single arbitrator under and in accordance with the provisions of the Second Schedule to the Agricultural Holdings Act, 1908.

(5) The Board may with respect to any land authorise any local authority to exercise on behalf of the Board any of the powers of the Board under this Regulation.

(6) A local authority authorised to exercise on behalf of the Board any of the powers of the Board under this Regulation may exercise such powers in respect of land of which the local authority is owner or occupier, and may retain the rents and profits arising from such exercise of these powers, but shall not be entitled to receive from the Board any rent or compensation for the use thereof or for the exercise by the local authority of any powers under this regulation in respect of that land.

School Food Gardens.

THE President of the Board of Agriculture has addressed an appeal to headmasters, head mistresses, and teachers in elementary schools throughout the country, and to the managers of non-provided schools, for help in the general scheme of increased food production.

He points out that there are about 3,200 school gardens, and he asks the teachers to make each one—"every foot of it—a prize kitchen garden." Although the actual addition which each individual child or separate school can make to the national food supply may be small, added together it may come to something substantial. He is convinced that every child will be proud that he or she is doing national work.

The Board of Education, Mr. Prothero adds, allow the work to be done in school hours, and he suggests that teachers should extend their work to the allotments and gardens of those who are with the forces or absent on other national service, to the distribution of seed potatoes, and to preparing the children to be useful on the farms during the holidays.

Issue of Bulletins by the Food Production Department.

IT is proposed by the Food Production Department to issue at short intervals bulletins containing notes on matters of interest to War Agricultural Committees.

These bulletins will be in three series :—

Series A.—Matters of general interest with regard to the organisation of food production.

Series B.—Reports on the progress and position of food production throughout the country.

Series C.—Technical memoranda with regard to the means by which food production may best be secured or increased.

Copies of all bulletins will be sent to each committee for the information of its members, and it is hoped by this means to keep all members of committees closely in touch with the action taken by the Government with regard to agricultural production, and to keep them informed of the experience which is being gained in other parts of the country. It is also hoped that the technical memoranda which will be issued will be of use to members of committees in securing that the best possible use is made in their areas of all the means of food production that can be made available.

Sowing of Spring Corn on Foul Land.

THE question has been raised by some War Agricultural Committees whether it would be in the national interest to sow spring corn on land which is in such a foul condition that only a small or medium crop can be anticipated, or whether it would be better to fallow the land or plant it with roots so as to clean it for the growing of corn for the harvest of 1918, when a full crop might be expected. In view of the fact that it is of urgent importance to neglect no means of increasing the harvest of 1917 the Board think it would be better to secure, where possible, even a small crop for that harvest, in spite of the fact that it might result in a reduced yield for the harvest of 1918. In this matter, however, the Board can only give general guidance and leave the decision of each case, with every confidence, to the discretion of the committees.

Appointments to the Board of Agriculture.

THE Duke of Marlborough has been appointed Joint Parliamentary Secretary (unpaid) to the Board of Agriculture and Fisheries, and will represent that Department in the House of Lords.

Mr. A. D. Hall, F.R.S., has been appointed Permanent Secretary to the Board in succession to Sir Sydney Olivier, K.C.M.G.

For appointments further to the above, see p. 1177.

POTATOES.

THE Seed Potatoes (Prices) Order, 1917, dated 24th February, 1917, makes the following (among other) provisions :—

Prices of Seed Potatoes.

2. The maximum price chargeable on the occasion of a sale of seed potatoes by or on behalf of the grower thereof shall be the price applicable to the variety of potatoes sold according to the First Schedule.

3. The maximum price chargeable on the occasion of a sale of seed potatoes by any person other than the grower thereof shall be as follows :—

(*a*) For potatoes of any particular variety of ½ cwt. or less comprised in any sale, the maximum price shall be 3*d*. per lb.

(*b*) All other potatoes comprised in any sale. The basis of the maximum price shall be the maximum price applicable to the variety sold on the occasion of a sale by the grower, and there may be added *first*, all sums (if any) actually paid for transport by rail or water in respect of the potatoes sold, and, *secondly*, if the sale be over ½ cwt. but less than 10 cwt., a sum at the rate of £2 10*s*. a ton ; or if the sale be 10 cwt. or more but less than 4 tons, a sum at the rate of £1 5*s*. a ton ; or if the sale be of 4 tons or more, a sum at the rate of £1 a ton.

4. Where, on the occasion of a sale, the buyer requires the potatoes sold to be placed on rail or on wharf, no additional charge may be made in respect thereof.

5. On the occasion of a sale regulated by Article 2 or Article 3 (*b*), a reasonable charge may be made for bags or other packages or the use thereof.

6. On the occasion of a sale regulated by Article 3 (*a*), no charge may be made for bags or other packages.

7. No person shall, in connection with a sale or proposed sale of seed potatoes,—

(*a*) Enter or offer to enter into any fictitious or artificial transaction ; or

(*b*) Impose or attempt to impose any condition relating to any other article ; or

(*c*) make or demand any unreasonable charge.

For the purpose of this Order seed potatoes shall mean potatoes of a variety specified in the first column of the Second Schedule of this Order, which will not pass through a riddle having such mesh as is specified in the second column of such Schedule in relation to such variety, and will, in cases where a mesh is specified in the third column of such Schedule, pass through a riddle having such mesh as is so specified.

Schedule I. gives the maximum price per ton to growers of the different varieties. Class I. means seed potatoes grown in Scotland in

1916; Class II., grown in England and Wales in 1916 from seed grown in Scotland or in Ireland in 1915; Class III., grown in England or Wales in 1916 from seed grown in England or Wales in 1915. The prices are as follows :—Early Puritan, Duke of York, Epicure, Eclipse, Sharpe's Express, King George V., Evergood, Arran Chief: I. £12, II. £11, III. £10 10*s*. British Queen: I. £12, II. £11 10*s*., III. £10 10*s*. Great Scot: I £14, II. £13, III. £10 10*s*. Royal Kidney: I. £11. II. £10 10*s*., III. £10 10*s*. King Edward VII.: I. £11, II. £11, III. £10 10*s*. Irish Queen, President, Factor, Table Talk, Dalhousie, Up-to-Date, Scottish Triumph, Duchess of Cornwall, Langworthy, What's Wanted, Golden Wonder, Abundance, Favourite, Twentieth Century, Northern Star, Black Skerry, Champion. Beauty of Bute: I. £11, II. £10 10*s*., III. £10 10*s*.

SCHEDULE II.

Variety.	*Mesh of Riddle.*	
	in.	in.
PART I.—Potatoes grown in the Mainland of Scotland and the Islands of Arran and Bute :—		
Arran Chief, King Edward, Great Scot, King George V.	1	—
All other varieties so grown	1¼	—
PART II.—Potatoes grown in England and Wales from Scotch seed of the 1915 crop :—		
Arran Chief, Great Scot, Early Puritan, Duke of York, Epicure, Eclipse, Sharp's Express	1	—
King George V.	1¾	—
Royal Kidney	1⅛	—
All other varieties so grown	1¼	2
PART III.—Potatoes grown in England and Wales from seed other than Scotch seed of the 1915 crop :—		
Early Puritan, Duke of York, Epicure, Eclipse, Sharp's Express	1	—
All other varieties so grown	1½	1¾

THE Potatoes 1916 Main Crop (Prices) Order No. 2, 1917, dated 24th February, 1917, is to the following effect :—

Prices of 1916 Main Crop Potatoes.

1. Except under the authority of the Food Controller, no potatoes of the 1916 crop may be sold at prices exceeding the maximum prices provided by this Order.

2. The maximum price applicable on the occasion of a sale of potatoes by or on behalf of the grower thereof to any person other than a retailer as hereinafter defined shall be :—

(*a*) for potatoes agreed to be delivered in February or March, 1917, at the rate of £9 per ton; and

(*b*) for potatoes agreed to be delivered after the 31st March, 1917, at the rate of £10 per ton.

3. The maximum price applicable on the occasion of a retail sale by or on behalf of a retailer of potatoes shall be :

(*a*) for potatoes agreed to be delivered in February or March, 1917, at the rate of 1½*d*. per lb.; and

(*b*) for potatoes agreed to be delivered after the 31st March, 1917, at the rate of 1¾*d*. per lb.

4. The maximum price applicable on the occasion of any sale of potatoes, other than such sales as are mentioned in Article 2 or Article 3, shall be :

(*a*) for potatoes agreed to be delivered in February or March, 1917, at the rate of £10 10*s*. per ton; and

(*b*) for potatoes agreed to be delivered after the 31st March, 1917, at the rate of £11 10*s*. per ton,

with the addition thereto (in either case) of all moneys actually paid for transport by rail or by water in respect of the potatoes sold, or where, delivery being made by the grower to a retailer, there has been no transport by rail or by water, of a reasonable charge for transport not exceeding a charge at the rate of 10*s*. per ton.

5. Where on the occasion of a sale regulated by Article 2 the buyer requires the potatoes sold to be placed on rail or on wharf no additional charge may be made in respect thereof.

6. On the occasion of a sale regulated by Article 3 no charge may be made for delivery to the buyer or for bags or other packages.

7. On the occasion of a sale regulated by Article 2 the maximum price shall not include the cost of bags or other packages, and on the occasion of a sale regulated by Article 4 no charge shall be made for bags or other packages or the use thereof.

8. No person shall in connection with a sale or proposed sale of potatoes

(*a*) enter or offer to enter into any fictitious or artificial transaction; or

(*b*) impose or attempt to impose any condition relating to any other article; or

(*c*) make or demand any unreasonable charge.

9. This Order shall not affect contracts for the sale of potatoes subsisting at the date of this Order.

10. No person shall sell or buy or offer to sell or buy any potatoes at a price exceeding the permitted maximum price on the occasion of such a sale.

11. This Order shall not until the 1st April, 1917, apply to seed potatoes as defined in the Seed Potatoes (Prices) Order, 1917, or to seed potatoes of a variety not mentioned in the First Schedule to such Order.

Growth of Celery.

IN some counties a considerable area of good land is normally devoted to the growth of celery. The total acreage under this crop in England and Wales in 1916 amounted to 3,515 acres. Under present conditions the Board think that the growth of celery should be restricted, where the crop occupies land that might be used for potato growing. It may be pointed out that a crop of celery of 6 tons per acre would produce less than one quarter of the amount of food contained in a crop of 7 tons of potatoes.

LABOUR AND MACHINERY.

Agriculture and Recruiting.

THE following Memorandum, dated 28th February, 1917, has been addressed by the Food Production Department of the Board to the Secretaries of the War Agricultural Executive Committees and to the Board's Representatives before the Appeal and Local Tribunals in England and Wales:—

(1) The President of the Board of Agriculture and Fisheries desires to acquaint you with the present position of men engaged in Agriculture in relation to Military Service.

(2) The War Cabinet have decided that 30,000 men employed in Agriculture, fit for general service, and who do not hold Certificates of

Exemption from the Tribunals, shall be released from Agriculture for service in the Army, and that no more men above that number are to be taken from Agriculture without the express approval and sanction of the War Cabinet.

(3) In order to secure this result with the minimum amount of inconvenience to farmers and of interference with food production, the War Office are issuing instructions to their Recruiting Officers to consult the representatives of the County War Executive Committees in order to decide which men should be called up for service for each Recruiting Area and Sub-Area.

(4) Particulars of the number of men called up for service with the Colours since the 12th of January last will be supplied to your Committee by the Officer Commanding the Recruiting Area.

(5) No men holding Certificates of Exemption should be called up for service with the Colours, and if they have been called up they will be returned to their civil occupations.

(6) Subject to the exigencies of the military situation, no more Class B or Class C men are to be taken from Agriculture, and if a man, on medical examination, is placed in either of these classes he will not be called up, or if he has been called up since the 12th of January last his Notice will be cancelled and he will be returned to his civil occupation.

(7) The War Office have agreed that where a farmer has on his farm only the amount of male labour set out in the scale known as the "Bath Agreement," and embodied in the Local Government Board Circular of the 22nd of June last, R.92, the position of his employees with regard to their liability to military service will not be affected in any way by the number of women a farmer may employ. In future, women labour is not to be regarded as in substitution for male labour, but to be supplementary only.

(8) With reference to the Proclamation dated the 30th January, 1917, calling up men of 18 for service with the Colours, the position with regard to applications to the Tribunals for Certificates of Exemption in respect of such men is as follows :—

In the case of men to whom the Military Service Acts apply :—

(*a*) Applications should be made before the 30th day after the date on which the man attained the age of 18 years.

(*b*) Applications may be entertained by the Local Tribunal if made after that date, if good reason is shown.

In the case of Voluntarily Attested men :—

(i) If not covered by the List of Certified Occupations, application should have been made in the case of men in Group A (*i.e.*, men born in 1898) not later than 10 days after the issue of the Public Notice calling up the Group in which the man is placed, *i.e.*, 9th February, 1917, and in the case of men in Group B (*i.e.*, man born in 1899) application should be made not later than a date 10 days after the day on which they attain the age of 18.

(ii) Application in respect of a man not covered by the List of Certified Occupations, may be entertained by the Local Tribunal after the dates mentioned in sub-paragraph (i) above if good reason is shown, but in any case not later than 7 days after individual notice has been sent to the man by the Military Authorities calling him up for service with the Colours.

(iii) If covered by the List of Certified Occupations, application may be made not later than 7 days after individual notice has been sent to the man by the Military Authorities calling him up for service with the Colours.

[NOTE.—Arrangements have now been made that the whole of the work of the War Agricultural Committees, *including* correspondence in regard to all questions affecting the relative claims of the Army and of Agriculture to the services of agricultural man-power, and in regard to all matters affecting the work of the Board's representatives before the Local and Appeal Tribunals, shall be dealt with by the Food Production Department of the Board.]

THE following Memorandum, dated 7th March, 1917, has been addressed by the Food Production Department of the Board to the Secretaries of the War Agricultural Committees and to the Board's representatives before the Appeal and the Local Tribunals in England and Wales :—

Military Service.

1. The attached copies of a Local Government Board Circular,* dated the 1st of March, 1917, R.122, of the Military Service Regulations (Amendment) Order, 1917, and of Army Council Instruction 366A of 1917, are sent for your information.

2. Special attention is drawn to the following alterations of the Regulations and Instructions.

(*a*) The Army Council have power to issue an Army Council Instruction authorising application to be made for the review of all individual Certificates of Exemption granted to men or classes of men specified in the Instruction. The altered Regulations and Instructions for Tribunals provide that when such a general application is authorised, it becomes at once the duty of the Tribunal to review any such Certificate without waiting for individual application by the Military Representative.

(*b*) Where a man holds a Certificate of Exemption granted on the ground that he is engaged in a Certified Occupation and such Certificate ceases to be in force after the 15th of March, 1917, he must now make application for a renewal before or within two weeks (instead of two months) after the date on which the Certificate ceases to be in force.

(*c*) In future, in the case of application for exemption on the ground that the man is in a Certified Occupation, the Military Representative may raise the contention, without previous written notice to this effect, that it is not necessary to retain the man in civil employment, even though he is in a Certified Occupation.

3. It will be observed that the general review, in accordance with the Army Council Instruction, of Certificates of Exemption granted to men who had not attained the age of 31 on the 1st of March, 1917, does not apply to a person who is in possession of a Certificate of Exemption granted on the ground that his principal and usual occupation is a Certified Occupation, or on the ground that he is engaged in agriculture, and that his continuance in such employment is in the national interests.

The Board's Representatives should, therefore, exercise vigilance in order to secure, so far as possible, that the Tribunals do not review inadvertently, certificates of exemption granted to men under 31

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* Not here printed.

who are engaged in agriculture or are covered by the List of Certified Occupations as affecting trades allied to agriculture, such as blacksmiths, wheelwrights, erectors and repairers of agricultural implements and machinery, fertiliser manufacturers, etc.

THE following Circular Letter, dated 21st February, was addressed by the Food Production Department of the Board to War Agricultural Committees in England and Wales :—

Employment of Conscientious Objectors.

SIR,—(1) I am directed by the President of the Board of Agriculture and Fisheries to say that the Committee on Employment of Conscientious Objectors, Home Office, can arrange for the employment on the land of men of military age, who, while in the Army, have been referred, on account of their objection to military service, to that Committee in order that they might be found work and transferred to Army Reserve W. In view of the urgent necessity for providing as much labour as possible for agriculture Mr. Prothero hopes that your Committee will carefully consider the possibilities of securing these men for employment. While they are at work they are not under military discipline, but subject only to civil control of the kind that can be exercised by a responsible person nominated by you (or, if you desire, by the employer, or body of employers) to act as agent for the Home Office Committee.

(2) Any man sent out who misbehaves or who is persistently idle, or is otherwise unsuitable for the work, will be removed if the employer requires, and, if necessary, will also be made the subject of disciplinary action by the Committee.

(3) The Home Office Committee prefer to send out men for work in groups, but would also be willing to supply them to be sent in small parties to individual farms, if your Committee would supervise the arrangements for such parties.

(4) Where the men are employed in groups the Home Office Committee will bear the expense of housing, feeding (up to 12*s*. 3*d*. per week per man) and clothing the men, and of medical attendance and insurance, and of paying them their personal remuneration of 8*d*. a day, less any deductions. Your Committee, or other employing authority, would have to undertake to house and feed the men, settling with the Home Office Committee the expense to be incurred, and charging it, when incurred, to that Committee, who would on the other hand be credited each month with the wages at the current local rates payable for ordinary civilian agricultural labourers (either skilled or unskilled in such work).

(5) Where it is proposed to send out small parties to farms, your Committee would have to arrange for the collection of information as to the farms on which this form of labour is required ; for the reception and dispatch to the farms of the men sent out, and for the inspection of the accommodation, etc., provided. The farmer would then pay to your representative the sum fixed by your Executive Committee, with the approval of the Home Office Committee, as representing the local current rate of wage for men either (*a*) skilled or (*b*) unskilled in agriculture, while your representative would pay the men the sum fixed by the Home Office as their personal remuneration (8*d*. a day, less any deductions) and account for the balance to the Home Office Committee In all cases the hours to be worked will be those obtaining

in similar work in the district. The Home Office Committee will pay the fares of the men to the nearest station.

(6) Applications for men, or for further information, should be made direct in envelopes marked "Agriculture" to the Secretary, Committee on Employment of Conscientious Objectors, Home Office, London, S.W., and should a representative of your Committee wish to obtain further information, or discuss proposals for employment in more detail, Mr. Arthur Locke, or Mr. G. G. Whiskard, of the Home Office, Whitehall, will be glad to see him.

I am, etc.,

T. H. MIDDLETON, *Director.*

Loan of Army Horses and Drivers to Farmers.

THE Board of Agriculture are informed by the Army Council that in view of the dearth of agricultural labour, and in some districts of horses suitable for farm work, and of the special importance of increasing our home production of food, they have directed commanders of units in possession of draught horses or mules to arrange for the temporary loan of horses and drivers to farmers in the vicinity of their stations who may require such help. The loan of animals and men is to be undertaken as far as is compatible with the efficiency of the unit and military transport requirements.

No extra expense in connection with housing or otherwise is to be incurred in this service. Payment will be required at the rate of 4*s.* per day for each horse for a working day of eight hours, farmers supplying without charge, forage, and where necessary, stabling. Drivers will be paid by the farmer at the rates already laid down by the Army Council.

Applications are to be made direct to the nearest commander of a unit in possession of suitable animals.

THE following Circular Letter, dated 7th February, was addressed by the Food Production Department of the Board to War Agricultural Committees in England :—

Motor Tractors and Ploughs.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that the Board are making arrangements to place motor tractors and ploughs at the disposal of the War Agricultural Committees, but it may be some time before any large number can be secured for the purpose. Details of the scheme have not yet been definitely settled, but the following brief outline of the proposals may be useful to you at this stage, though some amendments may be necessary before the full scheme is issued :—

(3) The tractors and ploughs will be the property of the Board of Agriculture and Fisheries.

(2) The arrangements for the use of the tractors and ploughs will be left in the hands of the War Agricultural Committees. The tractors will be let out to farmers or used by the Executive Committees in connection with work under the Cultivation of Lands Order, 1917.

(3) Preference should be given to land which might not otherwise be ploughed, but by its nature and condition may be expected to produce good crops in 1917.

(4) Until further notice each tractor will be sent out with a driver and ploughman, who will be soldiers, paid by the Military Authorities.

(5) A reasonable charge per acre for ploughing will be fixed by the Board of Agriculture and Fisheries, as well as a bonus per acre to be paid by the farmer to the driver and ploughman direct. Rates for overtime pay and Sunday work will likewise be fixed.

(6) The Military Authorities will supply petrol, paraffin, etc., and will arrange for any repairs being carried out.

(7) Payment by farmers for work done will be made to the Executive Committee, who will also decide any dispute as to acreage ploughed or payments due to driver or ploughman.

Mr. Prothero hopes to send you the detailed scheme at an early date, but in the meantime perhaps your Committee will forward to the Board, if they have not already done so, a reasonable estimate of the number of tractors required for immediate work in the county.

I am, etc.,

T. H. MIDDLETON, *Director.*

Agricultural Machinery.

A SEPARATE Section of the Food Production Department has been formed to deal with all matters in connection with the purchase, supply and working of motor tractors and other agricultural machinery.

Imports of Agricultural Machinery: Board of Trade Control.

IN connection with the recent prohibition of the import of agricultural machinery, the Board of Trade announce that the intention is to control the importation in order to ensure that the machinery it is desired to import is of the right type, fulfils the most useful purposes, and is distributed over the country in the districts where it is most required.

Applications for licences will be considered by the Department of Import Restrictions, 22, Carlisle Place, Westminster, S.W., if previously approved by the Director of Agricultural Machinery Branch, Ministry of Munitions, Hotel Victoria, Northumberland Avenue, W.C., to whom importers should first apply, giving full particulars of the machinery they desire to import.

The term "agricultural machinery" includes any machine, implement, vehicle or other article, or any part thereof, designed or adapted or commonly used for agricultural or dairy purposes.

Shortage of Ploughs.

OWING to the large demand for agricultural implements, especially ploughs, there will probably be a shortage in the near future. It has been pointed out to the Board, however, that in some counties there is a large number of ploughs which have been discarded because they are not of the latest type. Most of these ploughs are quite serviceable, and as many of them are wheeled they would be useful in the hands of inexpert ploughmen. The Board suggest, therefore, that where

Executive War Agricultural Committees anticipate any shortage of ploughs they should endeavour to arrange for the transfer of serviceable implements from farms where they will not be required to farms where they can be utilised with profit. This might be done by asking district committees to display notices in market centres asking farmers who have such implements, and those needing them, to send on their names to the committees, so that a transfer may be arranged ; or by whatever other means seems to the Executive most suitable.

Food Production Regulations.

REGULATION 2M under the Defence of the Realm Acts was published in this *Journal* for February, 1917, p. 1128. Amendments to this Regulation were published in the *London Gazette* of 13th March.

Power of Board of Agriculture to take Possession of Implements, etc.—For paragraph (1) (*b*) in Regulation 2M the following was substituted :—

"(*b*) take possession of any machinery, implements of husbandry or plant (other than machinery, implements, or plant in the possession or under the control of a dealer or manufacturer), or any farm produce, stock or animals, which, in the opinion of the Board, are required for the cultivation of land or the increase of the food supply of the country."

Power of Board of Agriculture to Determine Tenancy.—After paragraph (*e*) of Regulation 2M the following paragraphs shall be inserted :—

"and

(*f*) By notice served on the tenant of any land which or part of which, in the opinion of the Board, is not being so cultivated as to increase as far as practicable the food supply of the country, determine his tenancy of the land on such date as may be specified in the notice, or on the application of the landlord by Order authorise him in any such case to determine the tenancy in accordance with the terms of the Order ; and

(*g*) After entry on any land arrange for its cultivation by any other person whether by contract of tenancy or otherwise."

MANURES AND SPRAYING.

Economy in Phosphatic Manuring.

THE following Notice was issued to the Press on 16th February :—

In view of the difficulty of securing delivery of basic slag, superphosphate and other phosphatic manures, the President of the Board of Agriculture and Fisheries asks farmers not to apply phosphates to meadows and pastures during the remainder of the present season. All available supplies should be reserved for other crops, especially for roots and potatoes. Having regard to the short supplies it is not advisable to apply more than three-fourths of the usual dressings of these phosphatic manures, since better results may be expected from the same total weight of manure if the whole area under any particular crop is manured lightly, than if a part is heavily dressed and the balance left without artificial manure. This rule applies only where the land is uniform in quality. In those cases in which farmers know that certain fields are poorer than others the manurial treatment must be adapted to the special conditions.

Where land in good condition can be given full dressings of farmyard manure, artificial phosphatic manures may often be omitted without materially reducing the crops.

Superphosphate.

THE production of superphosphate has been reduced by approximately 50 per cent. in Great Britain and Ireland owing to the sulphuric acid hitherto used in its manufacture being taken for the manufacture of explosives.

The bulk of the superphosphate at present held by the manufacturers has already been sold to manure dealers or direct to farmers, and the further quantities which will be produced during the next few months will be disposed of in the same way. Farmers who have not yet obtained the supply they require for this season should communicate with their local manure dealers.

It is hoped that the supply next season may be greater, and farmers are urged not to order more than they will actually apply to the soil in the spring of 1917.

The Fertiliser Manufacturers' Association state that on 1st March, 1917, the net retail cash prices, free on rail, bags free, at makers' works in various parts of the country were approximately as follows:—

26 per cent.	soluble	phosphates,	£4 15*s*. to £4 17*s*. 6*d*. per ton.
30 ,,	,,	,,	£5 to £5 2*s*. 6*d*. per ton.
35 ,,	,,	,,	£5 17*s*. 6*d*. to £6 per ton.

Basic Slag.

OWING to the shortage in the supply of other phosphatic manures, the demand for basic slag is at the present moment greater than under normal conditions. Makers are believed to have sold their productions under contracts made some months ago, but supplies can, in many cases, be obtained through local manure dealers.

It is understood that the makers do not make a practice of selling to farmers direct, but refer applicants for supplies to agents or dealers.

The prices quoted by makers in England and Wales for sale to dealers, free on rail, at makers' works, are approximately at the rate of 2*s*. per unit of citric soluble phosphate, or at the rate of 1*s*. 9*d*. per unit of total phosphates of which from 80 to 90 per cent. is citric soluble, but the prices vary for different qualities.

Use of Lime.

THE following Notice was issued to the Press on 16th February:—

In view of the scarcity of artificial manures the attention of farmers is directed to the advantages of applying small quantities of lime in localities in which it can readily be obtained. Lime is itself an essential plant food: it will also unlock some of the stores of nitrogen and potash in the soil, especially on well-farmed but heavy soils, and, as a temporary measure, may therefore take the place of part of the manures which the land would otherwise require.

For particulars of the different kinds of lime and their use in agriculture, see Leaflet No. 170 (*The Use of Lime in Agriculture*), sent post free on application to the Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Application of Sulphate of Ammonia.

THE following Notice was issued by the Board on 28th February:—

Farmers who applied sulphate of ammonia in late autumn to wheat should now give an additional ½ cwt. to ¾ cwt. per acre to backward crops on poor land. Where there was no autumn dressing ¾ to 1½ cwt. per acre should be given. On poor land the oat crop should get ¾ to 1 cwt. sulphate of ammonia;

on land in fair condition ½ cwt. to ¾ cwt. will suffice. Orders for sulphate of ammonia should be placed with manure merchants at once. The price for the standard grade has been fixed at £16 per ton delivered at the purchaser's railway station in maker's bags.

Prices of Sulphate of Copper.

AN arrangement has been made with manufacturers of sulphate of copper whereby sulphate of copper will be sold for home consumption in the United Kingdom at the price of £50 per ton in quantities of not less than 2 cwt., delivered free on rail at makers' works, in makers' bags, net cash with order.

The price charged by dealers and merchants other than manufacturers, is not to exceed 6½*d.* per pound.

These prices are to apply to sulphate of copper, blue vitriol or blue stone of a standard quality of not less than 98 per cent. purity. They do not apply to sulphate of copper sold for export.

The prices stated above are below the market prices recently ruling.

To secure a maximum return the spraying of potatoes this summer is essential, and farmers and dealers are urged to order and take delivery at once of the sulphate of copper they are likely to require.

DESTRUCTION OF GAME.

THE following Regulation under the Defence of the Realm Acts was published in the *London Gazette* of 27th February :—

Prevention of Injury to Crops by Game Birds.

" 2R. (1) The Board of Agriculture and Fisheries may, with a view to preventing or reducing injury to crops by game birds,—

" (*a*) take, or authorise any body to whom the Board may delegate their powers as respects any locality to take, such action as in the opinion of the Board or of the body to which the powers are so delegated may be necessary for such purpose ;

" (*b*) provide for the manner in which game birds killed in pursuance of the action so taken may be disposed of ;

" (*c*) by order, authorise the killing and taking, the sale and purchase, and the possession, of any game birds at any time when the killing and taking, the sale and purchase, or the possession thereof would otherwise be unlawful.

" (2) A person authorised or directed to kill or dispose of game birds under this Regulation shall not be required to obtain for such purpose a licence to kill game, and shall have the same power of selling game killed by him or by the persons authorised by him as if he had a licence to kill game :

" Provided that nothing in this Regulation shall exempt any person from the provisions of the Gun Licence Act, 1870.

" (3) This Regulation shall apply to Scotland and Ireland with the substitution for the Board of Agriculture and Fisheries of the Board of Agriculture for Scotland and the Department of Agriculture and Technical Instruction for Ireland respectively."

AN amendment to Regulation 2R (printed immediately above) was published in the *London Gazette* for 13th March, and was to the following effect :—

Destruction of Hares and Wild Birds.

In sub-section (1) after the words "by game birds" there shall be inserted the words "or hares or to securing for the food supply of the country any migratory kind of wild bird."

In paragraphs (*b*) and (*c*) of sub-section (1) and in sub-section (2) there shall be substituted for the words "game birds" the words "birds or hares."

The Board made an Order under the amendment, which was explained in the following Notice issued to the Press by the Food Production Department on 14th March :—

"The Board of Agriculture and Fisheries have made an Order, authorising in England and Wales the killing during the month of March of wild duck and other migratory wild birds used for human food, with a view to securing for the food supply of the country the considerable number of such birds still in this country in consequence of the cold weather. The time for selling such birds has been extended to the 15th April.

The Order does not authorise tenants to kill such birds in contravention of their tenancy agreements."

THE following Notice was issued by the Board on 28th February :—

Destruction of Pheasants Order.

The Destruction of Pheasants Order made by the Board of Agriculture and Fisheries extends to the 31st March the season for killing pheasants, and authorises the War Agricultural Executive Committees of each county to take such action as is necessary to reduce the stock of pheasants on any land where there is a risk of substantial injury therefrom to crops. For this purpose the Committee may authorise the occupier to kill pheasants subject to certain limitations to be inserted in the authority which will include those applicable to the killing of ground game under the Ground Game Act.

THE following Circular Letter, dated 2nd March, 1917, has been addressed by the Food Production Department of the Board to War Agricultural Executive Committees in England and Wales :—

Destruction of Pheasants Order, 1917.

SIR,—1. I am directed by the President of the Board of Agriculture and Fisheries to enclose for the use of your Executive Committee copies of the Destruction of Pheasants Order, 1917, which has been made by the Board under the powers conferred by Regulation 2R, which was inserted in the Defence of the Realm Regulations by Order in Council dated 23rd February, 1917. A copy of such Regulation is appended to the Board's Order.

2. The Order authorises the Executive Committee, in any case where they are satisfied that the stock of pheasants on any land is not so reduced as to prevent substantial damage to crops by pheasants, to take any action that in their opinion may be necessary with a view to such reduction of the stock of pheasants as may be desirable to prevent substantial injury being done by them to the crops. The land-

lord or other person already entitled to kill pheasants on the land is enabled by Regulation 2R to continue doing so up to 31st March, 1917, without further authority.

3. For this purpose the Executive may authorise and direct the occupier to kill the pheasants on the land in his occupation. This authority and direction must be in writing, and must contain limitations similar to those applicable to the killing of ground game under Section 1 (1) of the Ground Game Act, 1880, of which sub-section a copy is appended to the Order: and it may also contain such further limitations as the Executive Committee think fit to impose.

4. Before the Executive Committee issue any such authority and direction, they should obtain a report as to the stock of pheasants on the land and the risk of substantial damage therefrom to the crops, and should also ascertain what steps the person entitled to kill the pheasants is taking to make the necessary reduction in their numbers.

5. If the Committee decide to issue such an authority and direction to an occupier, they may authorise him to dispose of the pheasants that he kills, or may provide for their disposal in such other manner as the Committee may think fit.

6. Article 2 of the Order extends to the 31st March, 1917, the time within which it is lawful to kill pheasants, and makes the consequential alteration of the period within which they may be sold.

7. Any tenant killing game under a direction issued by the Executive Committee under the Order will, by virtue of Section 1 (1) of the Defence of the Realm (Amendment) No. 2 Act, 1915, be protected from any claim in respect of non-fulfilment of his tenancy contract due to the necessity for compliance with that direction. The tenant will not require a game licence for this purpose, but must hold a gun licence.

8. It may be desirable in any authority and direction issued by the Executive Committee to call attention to the restrictions imposed by Article 2 (2) of the Order which are based on the existing Game Laws.

I am, etc.,

ARTHUR LEE, *Director-General of Food Production.*

Control of Timber.

THE Secretary of the War Office announces that Sir Bampfylde Fuller, K.C.S.I., C.I.E., has undertaken charge of the Department of the War Office which is dealing with the following matters, viz.:—

(1) The supply of timber for the use of the Army; (2) the control of the use of timber in the United Kingdom with a view to effecting economy in its use for all purposes; (3) the regulation of the purchase of such timber as may be imported from sources outside the United Kingdom whether on Government or private account; and (4) the stimulation of the felling of timber in the United Kingdom.

Sir Bampfylde Fuller's office is at Caxton House, Tothill Street, Westminster, S.W., and all communications on the subject should be addressed to him there.

He will be assisted by an advisory committee consisting of four or five timber merchants chosen by the Timber Federation, and by one or two other gentlemen representing firms of repute which do not belong to the Federation. Mr. Sutherland, who has been directing

the operations of the Home Grown Timber Committee, will continue those operations in forestry under Sir Bampfylde Fuller. For other branches of the work Sir Bampfylde Fuller is obtaining the services of trade experts in timber exploitation, in the packing and casing of goods, and in the economical construction of buildings.

The interests of the various Government Departments concerned in the use and conservation of timber will be watched by a consultative committee of representatives of those Departments.

As regards (2) and (3) above, the control will for the time being be limited to soft wood of all descriptions excepting pit props.—(*Board of Trade Journal*, 22nd February, 1917.)

THE Manufacture of Flour and Bread Order (No. 2), 1917, dated February 24th, 1917, is to the following effect :—

Manufacture of Flour and Bread.

1. Except under the authority of the Food Controller no person shall manufacture any wheaten flour other than a straight run flour.

2. Except under the authority of the Food Controller no person shall, after 12th March, 1917, mill any wheat so that the percentage of the extract of flour obtained from the cleaned wheat ground in his mill during any month or other period is less than the percentage (hereinafter called the prescribed percentage) ascertained on the basis of the percentages set forth in the Schedule hereto, or such other percentages as the Food Controller may from time to time prescribe.

Provided always that the following adjustments shall be made in ascertaining the prescribed percentage :—

(i) The percentage applicable to any Argentine wheat shall be increased by ¼ per cent. in respect of each ½ lb. by which the actual bushel weight of the Argentine wheat milled shall exceed the bushel weight specified as applicable thereto and shall be decreased by ¼ per cent. in respect of each ½ lb. by which the actual bushel weight shall be less than the bushel weight so specified.

(ii) In any case where the total product of the mill in question is obtained exclusively from English, Scotch and Irish wheat or any of them the percentage shall be less by one than the percentage otherwise applicable.

3.—(*a*) Except under the authority of the Food Controller there shall, after the 12th March, 1917, be mixed with the wheaten flour not more than 15 per cent. and not less than 5 per cent. of flour obtained from rice, barley, maize, maize semolina, oats, rye or beans or any other cereal for the time being authorised by the Food Controller.

(*b*) The mixture shall be made either by addition to the wheaten flour after it has been milled, or by milling the permitted cereals with wheat, or partly in one way and partly in the other way. In any case rice shall be milled to a 95 per cent. extraction, maize semolina to a 70 per cent. extraction, and maize and barley to a 60 per cent. extraction.

(*c*) The mixture shall be made by the miller before selling or otherwise disposing of his flour.

SCHEDULE.

Description of Wheat.	*Percentage.*
Choice Bombay	83
Australian	83
Blue Stem	81½
Walla Walla (white and red)	80½
Chilian	80
New Zealand	81
English	81
Scotch	80
Irish	81
No. 2 Club Calcutta	80
Choice White Kurrachee	80
Soft Red Kurrachee	80
Rosafe 62 lb.	78
Baril 61½ „	78
Barletta Russo 61½ lb.	78
No. 1 Hard Manitoba	81
„ 1 Northern Manitoba	80
„ 2 „ „	78
„ 3 „ „	76
„ 4 Northern Manitoba, Commercial Grade	70
„ 5 „ „ „	72
„ 6 „ „ „	67

Description of Wheat.	*Percentage.*
No. 4 Northern Manitoba, Special Commercial Grade	70
„ 5 „ „ „	63
„ 6 „ „ „	53
„ 1 Hard and Montana Winter (1916)	82
„ 2 Hard Winter (Chicago or Atlantic Grading (1916)	81
„ 2 Hard Winter (Gulf Inspection) (1916)	80
„ 2 Red Winter(Western) (1916)	81
„ 2 Red Winter (Seaboard Inspection) (1916)	80
Steamer Grade Winters (1916)	79
Red Winters. All other grades (1916)	81
Canadian Winters, red or white	80
No. 2 Chicago Spring (1915)	77
Durum	77
Japanese	79
Feed Wheat, Manitoba (1916)	43

Prohibition of Malting.

THE Malt (Restriction) Order, 1917, issued by the Food Controller, prohibits the manufacture, from barley or any other cereals, of any malt suitable for use in the brewing of beer. The Order does not apply to barley or other cereals already steeped at the date of the Order.

The expression "beer" includes ale, porter, spruce beer, black beer, and any other description of beer.

Maximum Prices for Hay, Oat and Wheat Straw.

AN Order of 27th February of the Army Council fixes maximum prices for hay, oat straw, or wheat straw in Great Britain, on the occasion of the sale by the producer, and the dealer or distributor respectively.

In the case of the *producer*, the following maximum prices per ton must not be exceeded :—

	Hay. £ s. d.	*Oat Straw.* £ s. d.	*Wheat Straw.* £ s. d.
England	5 10 0	3 0 0	2 10 0
Scotland	5 2 6	2 15 0	2 10 0

The above prices are deemed to include the price of carting to nearest railway station, but not the cost of cutting, trussing, tying or baling, or chaffing or chopping.

The Order amends that of 5th November (see this *Journal* for December, 1916, p. 902) as regards Great Britain, but does not affect the Orders prohibiting the lifting of hay and straw except under licence.

Slaughter of Cows and Heifers.

STATEMENTS have been made that the slaughter of dairy cows is proceeding on an excessive scale, and the Board have asked Executive Committees to make inquiries on the subject and inform them whether the statements are correct, and, if so, what action they suggest ought to be taken to prevent an undue depletion of dairy herds and to maintain the milk supply.

Early Lambs for Market.

REPRESENTATIONS have been made to the President of the Board of Agriculture that the preparation of fat lambs for the early market is attended with waste. The President does not concur with this view and does not propose to take any steps to interfere with the practice of bringing forward lambs for early sale. But he urges on breeders of such early lambs the importance of the utmost economy in the use of purchased feeding stuffs. He therefore suggests that the lambs should be prepared for market as far as possible on home-grown materials, and that they should be finished at a less ripe stage than is customary.

The President further suggests that, in view of the great shortage of feeding stuffs, which will become more pronounced during the forthcoming year, breeders of early lambs will, for the next season, modify their practice and ensure the fall of their lambs in such a month as will enable them to rear them on the produce of their farms with the minimum necessary amount of purchased food.

The attention of the President of the Board of Agriculture and Fisheries has also been drawn to the waste of food which is caused by the practice of bringing ram lambs to a high pitch of condition before sale. He urges that, in the present scarcity of feeding stuffs, all breeders of ram lambs will, as far as possible, modify their usual practice of high feeding, both as regards ram lambs and shearling lambs, and will only bring them forward to such a condition as is consistent with the proper performance of the purpose for which they are to be sold.

Control of Oil Seeds and Oil Cake.

THE Ministry of Munitions, by arrangement with the Ministry of Food and the Board of Agriculture, is assuming control of all fats, oils, oil seeds and their products, including oil cakes, soap, and margarine.

A new branch of the Explosives Department of the Ministry of Munitions is being organised under Mr. Alfred Bigland, M.P., as Controller, assisted by a Consultative Committee representing other Government Departments.

The secretary of the new branch is Mr. C. W. Bird, to whom communications should be addressed at the Oils and Fats Branch, Department of Explosives Supply, Ministry of Munitions, Storey's Gate, S.W. It is particularly desired that representations to the Controller of Oils and Fats, etc., should be put forward through trade associations and kindred bodies, and not by individuals and firms, in order to avoid unnecessary multiplication of correspondence.

Essential oils, butter, and lard are outside the scope of the new Department's activities.

PARLIAMENTARY QUESTIONS AND REPLIES ON AGRICULTURAL MATTERS.

Machinery for Food Production.—Replying to Mr. Lundon (21st February), Sir R. Winfrey stated that an outlay up to £370,000 has been sanctioned for the purpose of machinery in connection with the production of food in England and Wales.

Soldiers and Sailors (Gifts of Land).—Mr. Cecil Harmsworth (13th February) asked the President of the Board of Agriculture whether his Department have received any gifts of land under the Sailors and Soldiers (Gifts for Land Settlement) Act; and whether he will take steps to make the provisions of the Act more widely known?

Sir R. Winfrey: The only gift received at present is one of 300 acres in Herefordshire, and I had the pleasure the other day of visiting this estate and accepting this gift on behalf of the Government. It will make five or six excellent small holdings for discharged soldiers. With regard to the latter part of the question, the matter has already been referred to in the Press, but I will see if further publicity cannot be given, with a view to encouraging other landowners to make similar gifts.

Feeding Stuffs.—Mr. G. Lambert (22nd February) asked the Parliamentary Secretary to the Ministry of Food whether he will state what steps are being taken, and with what result, to reduce the price of feeding stuffs used for feeding milch cows and other cattle?

Captain Bathurst: At the instance of the Food Controller, the supply of maize was taken over by the Wheat Commission, with the result that prices have been reduced from the previous level. He also met representatives of the milling industry on the 7th February, with the result that the price of bran and middlings since that date has fallen by 15*s*. per ton. The restriction of the use of barley for malting purposes may reasonably be expected to cause a further reduction. This work is about to be handed over to the Ministry of Munitions, and that Department is setting up a Committee which will contain representatives of the three Departments of Agriculture.

Mr. Lambert: My hon. Friend has not referred to feeding cakes, which have risen in price very considerably. Has any action been taken?

Captain Bathurst: A considerable amount of action has been taken, but as it affects very largely the question of explosives, which is being dealt with by the Ministry of Munitions—it covers the case of glycerine, for instance—it is thought desirable that the Ministry of Munitions should deal with the matter, which it is about to do without delay.

Mr. Lambert: Will the Ministry of Munitions fix the price of feeding cakes?

Captain Bathurst: They will, I understand, fix the prices of the products and by-products of the seeds and nuts to which the hon. Gentleman refers, on the advice of a Committee largely composed of the representatives of the three Departments of Agriculture.

Slaughter of Lambs.—Sir R. Winfrey, replying to Mr. Jowett (28th February) stated that the subject of the slaughter of lambs has been

carefully considered, and as lamb is, in the present scarcity of food for live stock, one of the most economical forms of meat production, it is not proposed to restrict the slaughter (see also p. 1295).

Minimum Agricultural Wage.—In reply to Mr. King and other questioners (27th February), Sir R. Winfrey stated that the minimum wage of 25s. for agricultural labour is not necessarily a cash payment, as it is inclusive of allowances; that legislation on the subject will be introduced very shortly; that a mode of adjusting the allowances is now under the consideration of the Board; and that it would not be permissible for farmers to increase nominal rents and so lower the real minimum wage.

Soldiers for Agricultural Work.—In the course of a reply to Mr. Raffan (27th February) Sir R. Winfrey stated that the War Office propose to set aside some 15,000 men for agricultural work, who will be formed into agricultural companies and distributed throughout the country. In addition, 15,000 men will be temporarily released from the Home Defence Army for the spring cultivations.

Substitution of Other Crops for Hops.—Replying to Mr. Charles Roberts (27th February) Sir R. Winfrey said: The Board have received some inquiries on this subject (of hop-growing), and the President has to-day addressed a letter to the Hop Growers' Association and to the War Agricultural Committees in the hop-growing counties calling attention to the further restrictions on the output of beer and the need for reducing the acreage of hops in proportion. He has, in that letter, also suggested that the land thus diverted from the growing of hops should at once be utilised to increase the essential food supplies of the nation.

Sir R. Winfrey stated further that it is thought that the above suggestion will be sufficient, but that, if it is not, other steps will be taken; and that it is not very easy to turn hop-land into corn-land at a moment's notice.

Exemption of Skilled Farm Workers.—In reply to Mr. Raffan (27th February), Sir R. Winfrey made it clear that no powers similar to those of the Minister of Munitions as to "indispensability" of men will be conferred on the President of the Board of Agriculture; and that it will remain the duty of the Tribunals to decide whether, in any particular cases, further skilled men should be released for the Army. In exercising that duty, the Tribunals will undoubtedly bear in mind that all essential agricultural labour should be retained in order to maintain or achieve the highest possible production of home-grown food.

Price of Feeding Stuffs.—Mr. George Lambert (8th March) asked the Minister of Munitions what action has been taken to reduce the price of feeding cakes and other foods for cattle and live stock?

Mr. Kellaway: Departmental action already taken has prevented a further rise of price which appeared inevitable at the time control was vested in the Ministry of Munitions. A scheme, however, is being worked out by which the raw materials of these foods will be controlled and supplied to the manufacturers of feeding cakes and other foods for cattle on conditions limiting the price of the finished products. It is hoped that this scheme will result in improvement in the direction desired by my right hon. Friend. I cannot say more than this at the moment.

Maximum Prices for Welsh Wool.——Mr. Haydn Jones (8th March) asked what was the fixed minimum and maximum price per lb. for washed Welsh wool, 1916 clip?

Mr. Forster: There is no minimum price. The fixed maxima are as follows: Best Welsh, 14½*d.* per lb.; low Welsh, 13¼*d.* per lb.; Turbury Welsh, 11¾*d.* per lb. The above prices are for wools in good condition. Wools of inferior quality and intermediate sorts are valued in proportion.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Destruction of Weeds by School Children in Germany.—The German Agricultural Council has (at the instigation of the German Agricultural Society) urged the Ministry of Agriculture in Prussia, as well as public bodies in other German states, to approach all German school children, and, in the first place, the male and female school children in the country parishes, to help in the destruction of weeds this spring.

It is pointed out that, as the War has gone on, fields have become more and more overgrown with weeds, and that on this account, yields have diminished. The reason for the prevalence of weeds lies chiefly in the deficiency of human and animal labour, which is scarcely sufficient for tillage and harvesting operations.

As the destruction of weeds is easy work, which can be done by children, it is observed that a field of activity presents itself in which all German school children can do the greatest service for the Fatherland, and help in the prosecution of the War.

The work must begin early in March; it is therefore earnestly desired that the organisation of this work be taken in hand immediately, and that the entire teaching profession will co-operate.

Soldier Labour in Germany.—An Instruction was issued on 19th January from the Headquarters of the 4th Army Corps (in the Prussian Province of Silesia) to the effect that the greatest possible help in all directions was to be given to agriculture by Military Authorities and all arms of the service, so far as this was compatible with military efficiency. Assistance in the three following directions was indicated as regards spring work and harvest work in 1917:—

(1) Leave for agricultural work was to be granted as widely as possible, it being immaterial whether applications for such leave came from the men themselves or from employers, communal authorities, agricultural organisations, etc., or whether the men were to work on their own holdings or on other land. Precautions were to be taken to see that the men actually went to agricultural work, and punishment was to be inflicted for misuse of leave. Arrangements were to be made for bringing the men back as quickly as possible in case of need.

(2) In each reserve arm there was to be formed at least one flying gang of the strength of one sub-officer and 10 men. These gangs were to be placed as quickly as possible at the disposal of authorities on the demand of the latter, who were to take over all responsibility for the

necessary work in their districts being properly carried out. When unforeseen circumstances (the weather for instance) rendered it necessary, fully-trained men (militarily) could be included for a few days in the gang.

(3) Special arrangements were to be made for the formation of transport gangs.

German Meat Supplies.—The customary Quarterly Return, published on the 20th February by the German Imperial Statistical Office, of the number of slaughterings inspected under the German Meat Inspection Law gives some idea of the decline in German meat supplies. The decrease in the number of young cattle, calves and pigs is especially noticeable. The figures are as follows:—

—	Fourth Quarter.				
	1916.	1915.	1914.	1913.	1912.
Oxen	125,490	167,763	165,888	134,307	128,791
Bulls	95,323	160,071	164,925	114,591	96,924
Cows	330,011	702,506	504,341	416,887	431,130
Young Cattle over 3 months	169,220	590,493	250,441	233,713	254,137
Calves, up to 3 months ..	458,086	1,064,207	730,156	911,275	902,722
Pigs	1,987,883	2,679,486	5,695,050	5,071,170	4,693,128
Sheep	371,809	601,997	536,773	509,156	572,014

Bounty on Wheat Growing in France.—By a law dated 30th January last, the French Government pay a bounty of 3 francs per 100 kilog., approximately 5*s.* 3*d.* per quarter of 480 lb., on all wheat grown for the 1917 harvest. In addition, a bounty of 20 francs per hectare, approximately 6*s.* 6*d.* per acre, will be paid in respect of the area grown in excess of that of 1916.

Maximum Prices for Barley and Rye in France.—A Decree of 16th January, 1917, published in the *Journal Officiel*, fixes the following maximum prices to the producer: *Barley* (including winter barley) of all kinds and of good quality, weighing at least 48 lb. to the bush., and containing not more than 2 per cent. of impurities, 5*s.* 8*d.* per bush. of 50 lb. *Rye* of all kinds and of good quality, 5*s.* 6*d.* per bush. of 50 lb.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for February, 1917, issued by the International Institute of Agriculture contains the following particulars concerning the production of cereal crops in the Southern Hemisphere:—

Argentina.—The production of wheat in 1916-17 is estimated at 9,672,000 qr. against 21,575,000 qr. in 1915-16, a reduction of 55·2 per cent., while the area sown was smaller by 2·0 per cent.

Australia.—The total production of wheat is placed at 18,587,000 qr. in 1916-17, compared with 17,870,000 qr. in 1915-16, an increase of 4·0 per cent., the area sown being greater by 9·0 per cent.

Sowing of Winter Cereals in the Northern Hemisphere.—The areas estimated to have been sown with winter *wheat* in 1916-17, compared with the areas sown during the corresponding period of 1915-16, expressed as percentages, are as follows:—France 85, England and Wales 86, Switzerland 105, United States 102, British India 108; with *rye*: France 90, Switzerland 105, United States 121; with *barley*: France 110, Switzerland 106; with *oats*: France 95.

Live Stock in United States.—The numbers of live stock on farms and ranges on the 1st January, 1917, are as follows (the corresponding numbers on the 1st January, 1916, being shown in brackets): horses, 21,126,000 (21,159,000); milk cows, 22,768,000 (22,908,000); other cattle, 40,849,000 (39,812,000); sheep, 48,483,000 (48,625,000); pigs, 67,453,000 (67,766,000). (*Bulletin of Agricultural and Commercial Statistics*, February, 1917.)

Spain.—The production of grain crops in Spain in 1916 are officially estimated as follows: wheat, 18,927,000 qr. as compared with 17,082,000 qr. in 1915; barley, 10,240,000 qr. against 9,776,000 qr.; oats, 3,232,000 qr. against 3,789,000 qr.; and rye, 3,352,000 qr. against 3,040,000 qr. last season. (*Board of Trade Journal*, 8th March.)

United States.—According to a report issued on the 8th March by the Statistician of the Department of Agriculture, the estimated stocks of grain in farmers' hands in the United States on the 1st March, 1917, were as follows (stocks on the same date in 1916 in brackets): wheat, 101,000,000 bush. (241,717,000 bush.); oats, 394,000,000 bush. (596,600,000 bush.); barley, 33,000,000 bush. (60,511,000 bush.); and maize, 789,000,000 bush. (1,138,773,000 bush.). (*Broomhall's Corn Trade News*, 9th March.)

India.—According to the second general forecast, the area under wheat in India this season is estimated at 32,845,000 acres, as compared with 30,143,000 acres last season. The acreage this season is the largest yet recorded. (*Broomhall's Corn Trade News*, 16th March.)

Agricultural Conditions in England and Wales on 1st March.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during February, state that the severe frosts experienced during February prevented work on the land throughout the country, until the last week or so, when farmers became very busy with the preparation for spring sowings, and in some districts a certain amount of wheat was got in. All cultivation is, however, very backward for the time of year.

Autumn sown wheat appears to have taken little harm from the severe weather, and comparatively little re-sowing is thought to be necessary. That sown late is generally a poor plant, the earlier sown, as has been the case throughout the winter, looking much the better. A good deal of the late sown has still not yet germinated. In all parts of the country reporters state that top dressing would be of benefit to at least half the crop.

Seeds were cut by the frosts, but by the end of the month were nearly everywhere beginning to show signs of recovery; and in only a few districts is it thought that they have been seriously damaged, although they are often stated to be backward, and they are hardly as promising as on the 1st January.

Ewes have had a trying time, and have not always maintained their condition, which is, however, satisfactory considering the circumstances, especially where they have been well fed. Early flocks are lambing, and the fall appears to be about average so far; only in a very few districts is any unusual loss of lambs or ewes mentioned.

Live stock have generally done fairly well during February. Considerable inroads have been made in the supplies of winter keep, but it is generally thought that there is enough for the requirements of the rest of the season. A good many roots in the fields have been lost through the frosts.

Agricultural Labour in England and Wales during February.

ACCORDING to the Board's *Monthly Agricultural Report* for 1st March, 1917, the supply of labour during February was still very scarce, especially in the case of horsemen. Until the last week or so there was not very much to be done, but when work was resumed on the land the scarcity was more severely felt. The following local summaries give further details.

Northumberland, Durham, Cumberland, and Westmorland.—The deficiency in the supply was being felt, with ploughing possible. In some districts horses were idle owing to the shortage of horsemen.

Lancashire and Cheshire.—Labour was very short, but the deficiency was not so much felt as it otherwise would have been, owing to the difficulty of getting on the land. The shortage will be more marked as the season advances.

Yorkshire.—The supply of labour was very deficient; horsemen particularly were wanted in large numbers, and with work so backward farmers anticipate great difficulty in getting the spring work done.

Shropshire and Stafford.—The supply was exceedingly short, and depletion still continued.

Derby, Nottingham, Leicester, and Rutland.—Labour was everywhere reported as being deficient.

Lincoln and Norfolk.—There was a serious deficiency in all classes of labour, and farm work was very much in arrears.

Suffolk, Cambridge, and Huntingdon.—The shortage in the supply of labour was not much felt during February, as cultivation was not possible for the greater part of the month; but with open weather the deficiency is now being much felt. Wages have risen by 1s. a week during February in many districts.

Bedford, Northampton, and Warwick.—The supply of labour was getting more deficient, and wages have risen during the last two months. Farmers anticipate great difficulty in getting the spring work done.

Buckingham, Oxford, and Berkshire.—There was a great scarcity of all kinds of labour throughout the division.

Worcester, Hereford, and Gloucester.—Labour was everywhere very short, and men were required to look after the stock and work the teams. Wages show an upward tendency.

Cornwall, Devon, and Somerset.—Labour was very short, but the deficiency was not so severely felt, owing to the unfavourable weather. Wages showed a tendency to rise.

Dorset, Wiltshire, and Hampshire.—Labour was everywhere very short, and, with the increasing work now required on the land, hands are badly needed. Wages showed an upward tendency.

Surrey, Kent, and Sussex.—The supply of labour was seriously deficient, and the position was critical owing to difficulty in obtaining carters and stockmen.

Essex, Hertford, and Middlesex.—The supply of labour was inadequate, especially as the season is late.

North Wales.—The short supply of labour was keenly felt, especially as the available hands were more or less inefficient.

Mid Wales.—Labour was scarce everywhere, and insufficient for the proper management of farms.

South Wales.—The supply of labour is very scarce throughout the district.

The Weather in England during February.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 3rd Feb.:								
England, N.E. ...	32·1	—6·6	0·22	6	— 5	4	1·2	—0·8
England, E.	29·3	— 9·6	0·16	4	— 7	3	0·1	—2·3
Midland Counties ...	29·5	—9·6	0·08	2	—11	2	0·7	—1·2
England, S.E. ...	28·7	—11·5	0·04	1	—12	1	1·5	—0·8
England, N.W. ...	31·2	— 8·6	0·26	7	—11	2	1·5	—0·2
England, S.W. ...	29·8	—11·5	0·06	2	—19	1	2·6	+0·4
English Channel ...	33·2	— 10·9	0·03	1	—16	1	2·3	—0·4
Week ending 10th Feb.:								
England, N.E. ...	27·5	—10·9	0·04	1	— 8	1	3·3	+0·9
England, E.	28·0	—10·6	0·28	7	— 2	2	3·8	+1·4
Midland Counties ...	25·8	—12·7	0·07	2	—10	1	2·9	+0·9
England, S.E. ...	28·4	— 11·3	0·14	4	—10	1	4·8	+2·7
England, N.W. ...	28·4	—11·1	0·08	2	—15	1	3·1	+1·2
England, S.W. ...	28·7	— 12·2	0·11	3	—17	1	5·9	+3·7
English Channel ...	34·8	—9·0	0·08	2	— 14	1	6·5	+3·9
Week ending 17th Feb.:								
England, N.E. ...	33·4	—5·4	0·14	3	— 6	3	1·3	—1·4
England, E.	34·8	—3·7	0·14	4	— 7	3	1·6	—1·1
Midland Counties ...	33·0	—5·7	0·14	4	— 8	2	0·8	—1·6
England, S.E. ...	35·7	—4·5	0·16	4	—10	2	2·5	—0·3
England, N.W. ...	33·9	—5·7	0·17	4	—11	3	2·9	+0·4
England, S.W. ...	35·0	—6·3	0·15	4	—16	2	2·2	—0·5
English Channel ...	38·6	—5·5	0·17	4	—15	2	2·7	+0·4
Week ending 24th Feb.:								
England, N.E. ...	37·5	—1·2	0·57	14	+ 6	5	0·1	—2·7
England, E.	37·7	—1·2	0·43	11	+ 4	5	0·2	—2·7
Midland Counties ...	38·4	—0·1	0·68	17	+ 8	5	0·2	—2·4
England, S.E. ...	40·4	+0·3	0·60	15	+ 5	5	0·1	—2·9
England, N.W. ...	39·3	—0·3	0·77	20	+ 6	5	0·5	—2·2
England, S.W. ...	42·0	+1·2	1·04	26	+11	5	0·6	—2·5
English Channel ...	42·0	+0·1	1·22	31	+17	5	1·0	—2·5

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in February and January, 1917.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	February.		January.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	17 4	16 0	17 0	15 6
Herefords	16 7	15 2	16 4	15 3
Shorthorns	16 9	15 5	16 2	14 9
Devons	16 5	15 3	16 0	14 6
Welsh Runts	16 4	15 5	16 11	15 7
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	—	—	—	—
Sheep :—				
Downs	14½	13¼	15	13¾
Longwools	14	12¾	14	13
Cheviots	15¼	14	15	13¾
Blackfaced	14½	13½	14¼	13¼
Welsh	14¼	13	14	12¾
Cross-breds	14¾	13½	14½	13½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	14 11	14 1	13 9	12 11
Porkers	15 8	14 11	14 8	14 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	42 6	33 14	41 10	33 11
,, —Calvers ...	39 14	31 14	38 17	31 6
Other Breeds—In Milk ...	42 10	31 1	41 12	32 8
,, —Calvers ...	29 0	27 10	28 0	26 0
Calves for Rearing	3 8	2 14	3 7	2 13
Store Cattle :—				
Shorthorns—Yearlings ...	16 5	14 13	15 14	13 18
,, —Two-year-olds...	25 5	21 16	24 8	21 4
,, —Three-year-olds	32 11	27 15	31 6	26 6
Herefords —Two-year-olds...	30 9	23 1	27 12	22 14
Devons— ,,	27 12	22 17	25 0	21 10
Welsh Runts— ,,	24 1	20 7	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	66 5	57 3	70 7	58 8
Store Pigs :—				
8 to 12 weeks old	30 11	23 7	26 7	19 6
12 to 16 ,, ,, ...	53 3	41 6	46 8	36 10

* Estimated carcass weight.

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in ENGLAND in February, 1917.

(Compiled from Reports received from the Board's Market Reporters).

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF :—											
English	1st	115	0	116	6	—		118	6	118	0
	2nd	110	0	112	0	—		113	6	112	0
Cow and Bull	1st	106	6	111	6	107	6	104	0	106	6
	2nd	99	6	106	0	88	6	99	0	99	6
Irish: Port Killed	1st	—		113	6	115	6	116	0	114	6
	2nd	—		108	6	109	6	111	6	109	6
Argentine Frozen—											
Hind Quarters	1st	98	0	—		—		102	0	—	
Fore ,, ...	1st	—		—		—		90	0	—	
Argentine Chilled—											
Hind Quarters	1st	113	0	111	6	112	0	112	6	112	0
Fore ,, ...	1st	100	6	97	6	98	0	98	0	98	0
American Chilled—											
Hind Quarters	1st	—		—		—		115	6	—	
Fore ,, ...	1st	—		—		—		101	0	—	
VEAL :—											
British	1st	114	6	—		—		126	0	—	
	2nd	104	0	101	6	103	0	107	6	100	6
Foreign...	1st	—		—		—		—		—	
MUTTON :—											
Scotch	1st	121	6	124	6	129	6	123	6	127	0
	2nd	113	0	115	0	112	0	114	6	120	0
English...	1st	121	6	126	0	—		116	6	122	6
	2nd	113	0	116	6	—		107	6	115	6
Irish: Port Killed	1st	121	6	—		123	6	—		119	0
	2nd	116	6	—		113	0	—		114	6
Dutch	1st	—		—		—		105	0	—	
Argentine Frozen	1st	101	6	101	6	97	6	101	6	97	6
New Zealand ,, ...	1st	86	6	93	6	85	6	87	6	85	6
LAMB :—											
British	1st	140	0	—		—		140	0	—	
	2nd	130	6	—		—		130	6	—	
New Zealand	1st	100	6	100	6	98	0	98	0	98	0
Australian	1st	100	6	100	6	98	0	98	0	98	0
Argentine	1st	114	6	107	6	106	0	116	0	106	0
PORK :—											
British	1st	132	0	130	6	128	6	123	6	125	0
	2nd	122	6	121	6	115	6	109	6	115	6
Frozen	1st	104	6	104	0	97	6	103	0	101	6

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in February, 1917.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	26 0	25 0	—	—	23 6	22 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
" Factory	—	—	—	—	200 6	196 6
Danish...	—	—	—	—	222 0	220 0
French...	—	—	—	—	213 0	208 0
Dutch	—	—	—	—	198 0	194 0
American	195 0	191 0	195 0	192 0	190 0	186 0
Australian	217 0	215 0	210 0	206 0	212 0	207 6
New Zealand	224 6	221 0	223 0	219 6	220 0	215 6
Argentine	—	—	203 0	201 0	206 6	202 6
CHEESE:—						
British—						
Cheddar	160 6	156 6	156 6	144 0	163 0	156 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	172 6	167 0	172 0	166 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	158 6	155 0	156 0	153 0	162 0	158 6
BACON:—						
Irish (Green)	146 6	139 0	134 0	131 0	140 0	135 0
Canadian (Green sides)	128 6	126 0	128 0	125 6	128 6	124 0
HAMS:—						
York (Dried or Smoked)	177 6	172 0	—	—	178 6	172 6
Irish (Dried or Smoked)	—	—	—	—	161 0	155 0
American (Green) (long cut)	117 6	114 6	118 6	116 0	119 6	115 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	—	—	—	—	26 5	24 7
Irish	24 10	—	26 1	24 9	25 6	24 4
Egyptian	13 1	12 3	13 3	11 6	13 10	12 10
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	257 6	237 6	—	—	236 0	223 6
Edward VII.	270 6	253 0	238 6	235 0	244 0	233 6
Up-to-Date	266 6	249 0	235 0	225 0	235 0	223 6
HAY:—						
Clover	—	—	150 0	140 0	142 6	134 6
Meadow	—	—	—	—	142 0	134 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1915, 1916 and 1917.

Weeks ended (*in* 1917).		Wheat. 1915.	Wheat. 1916.	Wheat. 1917.	Barley. 1915.	Barley. 1916.	Barley. 1917.	Oats. 1915.	Oats. 1916.	Oats. 1917.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan.	6 ...	46 2	55 8	76 0	29 7	47 8	66 4	26 5	31 5	47 1
,,	13 ...	48 9	56 7	75 8	30 5	48 6	65 7	27 6	31 11	47 2
,,	20 ...	51 6	57 2	75 8	31 3	49 6	64 9	28 10	32 6	47 4
,,	27 ...	52 8	58 0	75 10	32 5	51 0	64 5	29 10	32 11	47 8
Feb.	3 ...	53 3	58 3	75 10	33 7	52 5	64 0	30 3	32 4	47 3
,,	10 ...	54 8	57 6	76 0	34 7	52 10	63 5	31 1	32 2	46 11
,,	17 ...	56 0	56 11	76 3	34 11	53 6	63 8	31 5	31 9	47 3
,,	24 ...	56 0	58 2	76 9	35 3	54 2	63 9	31 8	32 2	47 8
Mar.	3 ...	55 11	59 4	77 4	34 6	55 7	64 0	31 8	32 4	48 0
,,	10 ...	54 8	58 2	78 0	33 5	55 6	63 7	31 0	32 3	48 7
,,	17 ...	53 9	57 9		32 2	55 4		30 7	31 10	
,,	24 ...	54 3	55 11		31 11	54 6		30 6	31 4	
,,	31 ...	54 6	53 6		31 9	53 8		30 6	30 5	
Apl.	7 ...	54 9	51 8		31 3	53 7		30 4	30 1	
,,	14 ...	55 4	53 2		30 10	53 1		30 5	30 7	
,,	21 ...	56 5	55 3		31 5	52 10		30 11	31 8	
,,	28 ...	58 3	56 3		32 7	53 5		31 5	32 4	
May	5 ...	60 5	55 7		33 3	53 1		32 4	32 10	
,,	12 ...	61 7	55 5		34 0	53 5		32 5	33 1	
,,	19 ...	62 0	55 0		34 1	52 10		32 8	33 0	
,,	26 ...	61 11	54 7		34 8	52 9		32 7	33 4	
June	2 ...	61 9	53 3		35 4	53 9		32 5	33 3	
,,	9 ...	60 1	51 2		34 5	52 8		32 4	32 7	
,,	16 ...	56 1	48 10		34 3	50 9		31 9	32 1	
,,	23 ...	52 0	47 6		34 4	49 10		31 9	31 3	
,,	30 ...	49 5	46 3		35 3	49 1		31 1	30 10	
July	7 ...	50 1	46 3		34 7	45 6		31 6	30 8	
,,	14 ...	52 7	48 11		35 8	47 5		31 6	31 6	
,,	21 ...	53 10	51 6		35 10	48 8		32 1	32 3	
,,	28 ...	55 3	53 5		36 1	47 2		31 1	32 5	
Aug.	4 ...	55 4	55 1		35 7	46 1		31 5	32 9	
,,	11 ...	55 2	56 7		37 0	46 11		31 7	31 2	
,,	18 ...	54 3	58 1		39 4	48 0		31 4	30 8	
,,	25 ...	51 11	59 0		38 3	47 1		30 0	31 6	
Sept.	1 ...	45 3	59 4		38 1	48 5		26 10	30 5	
,,	8 ...	43 0	59 3		37 11	51 7		26 8	31 1	
,,	15 ...	42 9	59 11		39 0	52 6		26 4	30 9	
,,	22 ...	43 3	59 4		39 8	53 3		26 1	30 9	
,,	29 ...	43 5	58 10		40 4	54 1		26 5	31 1	
Oct.	6 ...	44 1	59 2		41 0	54 5		26 5	30 9	
,,	13 ...	45 9	59 7		42 3	53 10		27 1	31 6	
,,	20 ...	48 2	60 9		44 0	53 8		28 1	31 11	
,,	27 ...	50 3	62 10		46 2	54 6		29 1	32 10	
Nov.	3 ...	51 6	66 7		47 3	56 2		30 4	34 0	
,,	10 ...	52 8	69 8		47 5	58 0		30 11	35 8	
,,	17 ...	53 6	70 9		47 11	59 8		31 3	37 8	
,,	24 ...	54 2	70 8		48 7	61 8		31 1	39 7	
Dec.	1 ...	53 7	71 3		48 11	63 1		30 11	41 4	
,,	8 ...	52 10	72 1		47 10	65 6		30 4	44 1	
,,	15 ...	53 11	73 2		47 5	66 5		30 6	45 10	
,,	22 ...	53 10	74 8		47 2	67 3		30 7	46 5	
,,	29 ...	54 9	75 10		47 5	67 5		30 10	47 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of February, 1915, 1916, and 1917.

—	WHEAT.						BARLEY.						OATS.					
	1915.		1916.		1917.		1915.		1916.		1917.		1915.		1916.		1917.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London ...	57	1	58	11	77	5	35	0	52	2	64	9	32	7	33	6	49	2
Norwich ...	54	3	56	1	75	1	34	8	53	1	62	0	31	7	31	6	47	2
Peterborough	55	1	56	11	75	8	35	1	52	2	63	1	31	2	31	11	47	3
Lincoln ...	55	0	58	5	77	0	34	10	52	9	63	11	30	9	31	6	46	9
Doncaster ...	53	10	58	5	75	9	33	4	53	4	63	5	29	8	31	11	46	9
Salisbury ...	54	0	57	4	75	3	35	3	54	4	63	5	33	4	32	9	46	5

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on 1st March, 1917, certain diseases of animals existed in the countries specified :—

Austria (*on the 7th February*).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Denmark (*month of December*).—Anthrax Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

France (*for the period 21st January—3rd February*).—Anthrax, Black-leg, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (*for the period 1st—15th February*).—Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Swine Fever.

Holland (*mon h of January*).—Anthrax, Foot-and-Mouth Disease, Foot-rot, Swine Erysipelas.

Hungary (*on the 7th February*).—Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (*for the period 29th January—4th February*).—Anthrax, Black-leg, Foot-and-Mouth Disease (930 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (*month of December*).—Anthrax, Black-leg.

Russia (*month of September*).—Anthrax, Cattle-plague, Foot-and-Mouth Disease (58,366 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of September*).—Anthrax, Black-leg, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of November*).—Anthrax, Black-leg, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

Switzerland (*for the period 5th—11th February*).—Anthrax, Black-leg, Foot-and-Mouth Disease (3 "étables" entailing 63 animals, of which 3 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries : Belgium, Bulgaria, Montenegro, Rumania, Serbia.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1917.	1916.	1917.	1916.
Anthrax:—				
Outbreaks	61	46	117	102
Animals attacked	71	60	131	118
Foot-and-Mouth Disease:—				
Outbreaks	—	1	—	1
Animals attacked	—	24	—	24
Glanders (including Farcy):—				
Outbreaks...	3	9	5	13
Animals attacked	7	27	9	40
Parasitic Mange:—				
Outbreaks	353	335	677	724
Animals attacked	757	769	1,445	1,854
Sheep-Scab:—				
Outbreaks	111	40	252	127
Swine Fever:—				
Outbreaks	150	293	309	607
Swine Slaughtered as diseased or exposed to infection	40	890	103	1,934

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1917.	1916.	1917.	1916.
Anthrax:—				
Outbreaks	1	—	2	1
Animals attacked	1	—	2	5
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	1	—	1	—
Animals attacked	1	—	1	—
Parasitic Mange:—				
Outbreaks	2	8	7	17
Sheep-Scab:—				
Outbreaks	57	64	124	129
Swine Fever:—				
Outbreaks	19	18	31	36
Swine Slaughtered as diseased or exposed to infection	133	49	199	85

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